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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED

THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:

ELECTRO-PLATERS REVIEW

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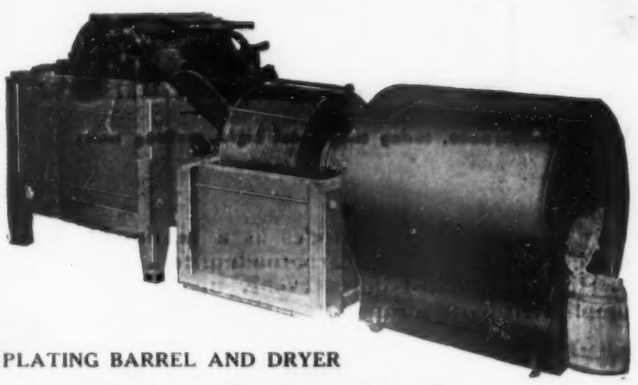

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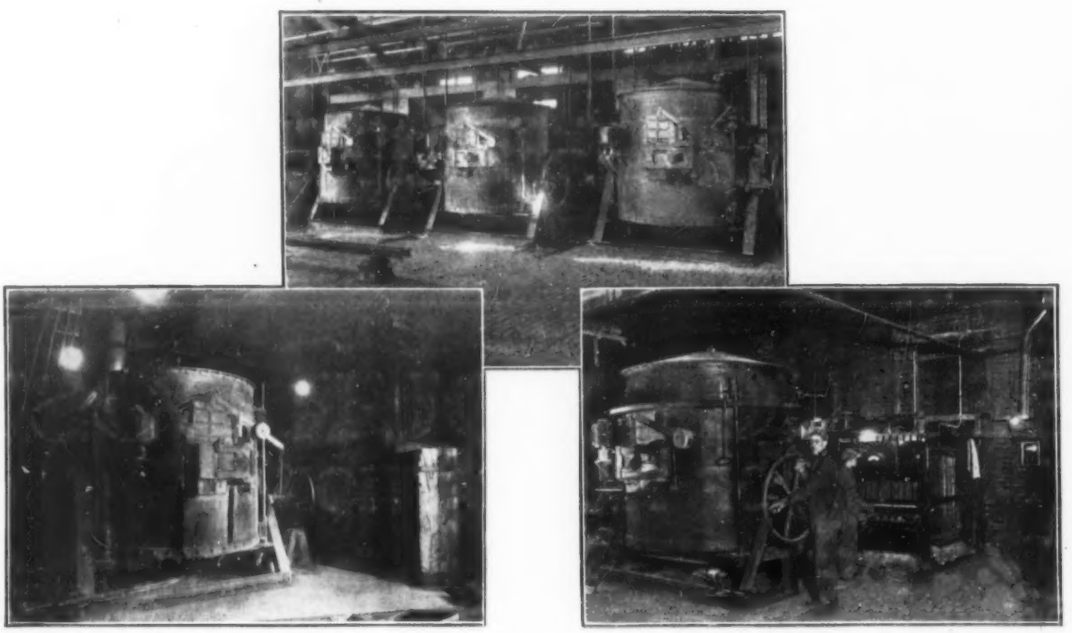

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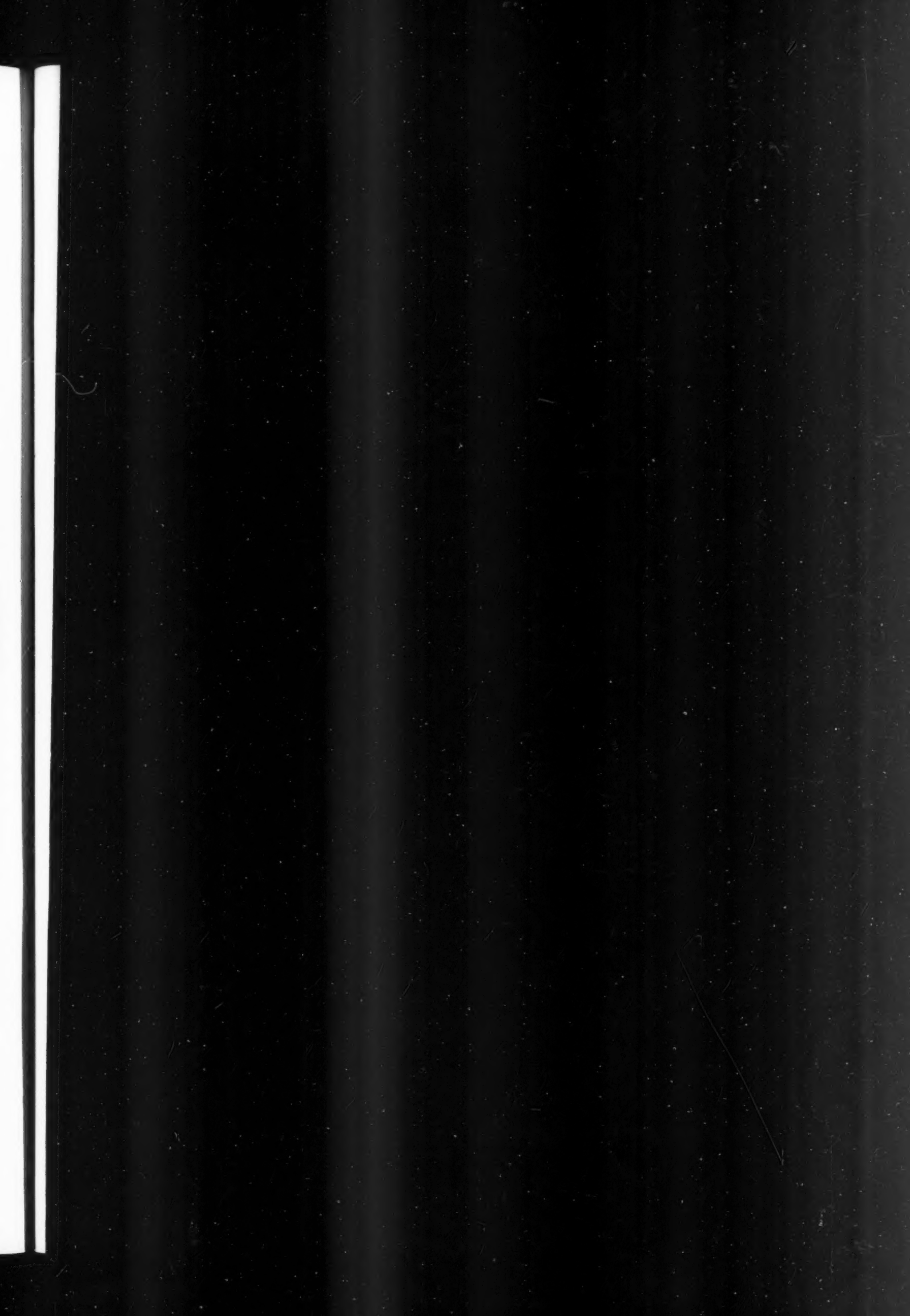

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THE METAL INDUSTRY

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THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:

ELECTRO-PLATERS REVIEW

Vol. 17 NEW YORK, NOVEMBER, 1919 No. 11

Owing to the printers' strike in New York City, which delayed the issue of THE METAL INDUSTRY, we were unable to place our November number in our readers' hands until the present. The number is also short eighteen pages of reading matter, but we shall make up this discrepancy in subsequent issues. We thank our subscribers and advertisers for their forbearance.

THE METAL TRADES CONVENTION

A Report of the Joint Meeting and Exhibition of Foundry Supplies and Appliances Held at Philadelphia, Pa., Sept. 29-Oct. 3, 1919, by the American Foundrymen's Association and the Institute of Metal Division of the American Institute of Mining and Metallurgical Engineers.

It is peculiarly fitting that the greatest convention ever held by the American Foundrymen's Association should have been placed in Philadelphia, the city where in 1896 it was first organized. It was Philadelphia's due that the largest and most brilliant gathering of experts and authorities on foundries and foundry machinery should be held in her midst. Long lists of figures are dull reading. It should be sufficient simply

EXHIBIT OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION IN THE COMMERCIAL MUSEUM, PHILADELPHIA, PA.

Officers of the Institute of Metals, Division of the American Institute of Mining and Metallurgical Engineers

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CONSULTING METALLURGICAL ENGINEER,
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to state that there were over 3,500 paid admissions to the exhibit in addition to those who had entrance due to their own private exhibits. The words were on everyone's tongue, "Biggest and best convention we have had."

The atmosphere was entirely different from that of last year, when we were at war. The men came then to see what there was to see, and to find out what other men thought. No one knew exactly what he wanted or whether he wanted it. No one could say for a certainty that he would be able to buy anything or if he could afford not to buy. There was a strained tense air of expectancy and anxiety. This year, however, with the nation at peace, conditions had changed. Men came from everywhere knowing very closely what they wanted. They came with definite plans made, and a good idea of their needs, and looking only for the very best that would satisfy them. As one prominent exhibitor stated, "They know what they want and they know how to go about getting it. We have had twice as many live inquiries this year as we had last."

The exhibitors did themselves proud. There were brilliant displays of every description, the cost of which in some cases ran into the thousands. They were there to spread themselves and they did it with a vengeance. Nothing was too good for the Foundrymen's Convention. In our equipment columns will be found a few of the new machines exhibited. Space does not permit us to show them all this month.

THE OPENING SESSION.

At 10 a. m. Tuesday, September 30, in the ball room of the Bellevue-Stratford Hotel, the joint opening sessions of the American Foundrymen's Association and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers was opened by the President of the American Foundrymen's Association, Mr. A. O. Backert. Mr. Backert at the close introduced or rather presented to the assembly Mr. Thomas Devlin. Mr. Devlin needed no introduction to anyone. He is the veteran foundryman of the United States, having been in the business for 65 years. Whether or not his healthy and hearty appearance was due to his profession might perhaps be argued, but at any rate, one thing was certain, Mr. Devlin had seen the foundry industry grow in his section. He had helped it perhaps more than any one man, and had left his mark indelibly upon it. As he stated he was an old timer, who began in the shops and still worked in them. He modestly admitted to being a "back number." But the distinguished gathering of prominent foundrymen and metallurgists present knew quite well that he was anything but a "back number." Nobody could be a back number and remain in this field which has made such great strides, for 65 years. Mr. Devlin spoke among other things of the organization of the American Foundrymen's Association, and mentioned Mr. Penton as one of its first officers. After he had finished Mr. Penton answered in a very neat extemporaneous speech. It was a very pretty exchange of bouquets.

Mr. Cattell, the Chief Statistician of Philadelphia, made a very appealing and patriotic address. It was patriotic not only as regards the country as a whole, but as regards Philadelphia in particular. He proved conclusively that Philadelphia was anything but slow, by quoting figures to the effect that she built three homes per hour, one pair of socks every two seconds, and numerous other articles among which was included one baby every 14 minutes.

Mr. Pero, one of the veteran officers of the Association, appealed to the organization to buckle down to the problems of peace and re-organization which are much greater than those of war.

Mr. Howe, of the National Research Council, Washington, D. C., delivered a paper on "The Need of Co-operative Research in Alloys."

The most interesting report was one by Mr. Franklin G. Smith, Chairman of the Publicity Committee of the Equipment Manufacturers' Association. He gave in a few words a sketch of its aims, which were briefly, the general improvement of foundry equipment regardless of who manufactured it, or to whose private benefit it would accrue. It is a remarkable organization with the most commendable purpose of improving the quality of the product in general. It is not philanthropic but co-operative, based, as Mr. Smith stated, on the principle that what we do for others helps ourselves. Mr. Smith gave the encouraging news that in spite of the youth of the organization real progress had been made.

Other papers presented at this meeting were as follows:

Considerations Affecting Brass Melting in Gray Iron Shops, by Russell R. Clark, Eagle Brass Foundry, Seattle, Wash. (Published in this issue.)

The Weeks Electric Rotation Furnace as Applied to the Brass Foundry Industry, by F. J. Ryan, American Metallurgical Corporation.

Tuesday afternoon all meetings were postponed so that everyone could take the boat trip on the Delaware River, terminating with a visit to the Hog Island Shipyard, the largest shipbuilding plant in the world. There the visitors were afforded the unusual opportunity of seeing a launching. The trip was so arranged as to enable the sightseers to include the Cramp Shipyards in their itinerary.

MEETING OF THE INSTITUTE OF METAL DIVISION.

Tuesday evening the meeting of the American Institute of Metals was held with its Chairman, William M Corse presiding. In a very short talk which he stated distinctly was not an address, he disposed of the necessary announcements and business before the technical program. It was announced that hereafter in accordance with the rules of the American Institute of Mining and Metallurgical Engineers, all elections would be held by mail.

Two very important papers were read: Physical Properties of Nickel, by David H. Brown and John F. Thompson, and Some Properties and Applications of Rolled Zinc Strip and Drawn Zinc Rod, by C. H. Matthewson, New Haven, Conn., C. S. Trewin, New York, and W. H. Finkeldey, Palmerton, Pa. These two papers were most interesting, and elicited considerable discussion. Among the questions asked about the physical properties of nickel was one by Jesse L. Jones, on whether high carbon nickel was corroded in the plating bath more easily than low carbon nickel. Dr. Thompson answered this in the affirmative.

Much discussion was centered about the problem of corrosion, which seems still to be the same unknown quantity that it has always been. A number of those present expressed the desire to know more about the corrosibility of different metals under different conditions, but so far no one has been able to make any headway, even with a satisfactory corrosion test.

WEDNESDAY, OCT. 1.

At 10 a. m. the following papers were presented before the Institute of Metals Division:

Five Foundry Tests of Zinc Bronzes, by C. P. Karr. (Published in this issue.)

Influence of Heat Treatment on Gun Metal, by C. F. Smart.

Lead Zinc Bronzes, by H. F. Staley and C. P. Karr.

Manufacture and Electrical Properties of Manganin, by F. E. Bash.

Manufacture and Electrical Properties of Constantan, by F. E. Bash.

Tin Fusible Boiler Plug Manufacture and Testing, by L. J. Gurevich and J. S. Hromatko.

Simplification of Inverse-Rate Method for Thermal Analysis, by P. D. Merica.

Mr. C. P. Karr, in answer to some remarks by Mr. Bassett, of the American Brass Company, who was presiding, stated that the best pouring temperature for Government Bronze, that is the 88 copper, 10 tin, 2 zinc metal, was at 1150 deg. If it was necessary at any time to heat the metal above this point, it could be allowed to cool back to 1150 deg. and then poured with good results.

Mr. Corse remarked that it was difficult to obtain the desired elongation properties in thin long castings of this metal. Mr. McKinney agreed with him.

On the papers by Mr. Bash on the Manufacture and Electrical Properties of Manganin and Constantan, there was much interested comment. Mr. F. L. Reide asked if instrument makers were taking any steps to standardize their product expecially with respect to the resistance of the wires used. Mr. Bash answered that as yet nothing had been done. Mr. Bassett asked if Mr. Bash had investigated Managanin without Nickel. Mr. Bash answered that he had not, because he had carried experiments on composition only far enough to discover one formula which was satisfactory. After this was discovered he had gone no further.

On the paper "Influence of Heat Treatment on Gun Metal," by C. F. Smart, Mr. R. F. Wood stated that he had made some experiments, machining the parts before treating, then heating to 700-800 deg. Fahr., but found that the tensile strength and elasticity were greatly decreased. Mr. McKinney stated that quenching was necessary to get the best results, in that it prevented the increase of grain size. Mr. Corse asked if there was not considerable danger of cracking large or intricate castings in the quenching process, to which Mr. McKinney answered that there was, and that the castings would have to be handled very carefully as this composition was inclined to red shortness.

On the paper by Mr. Staley and Mr. Karr on the Physical Properties of Certain Lead Zinc Bronzes, in which a number of different compositions were tried in order to find a substitute for the 88-10-2 alloy, it was developed that so far as the experiments had been carried out a mixture running 90 copper, 6.5 tin, 2 zinc, and 1.5 lead gave the best results. Mr. Corse asked just what uses could be made of this new alloy, to which Mr. Karr answered that it could be used for steam valves, pistons and in general substituted for the 88-10-2 mixture. Mr. McKinney stated that this alloy showed a loss in bearing qualities. The 88-8-4 alloy with a little lead would be water tight and an excellent substitute for the 88-10-2 metal. He stated also that it was very likely that if the tin were slightly reduced the zinc kept low and a little nickel added the toughness and hardness would be increased. Also, such an alloy would provide an excellent outlet for all the cupronickel scrap now lying idle. Mr. R. F. Wood stated that he had used the 90-6.5-2-1.5 mixture, but had substituted one per cent of nickel for one per cent of copper. This mixture had given him excellent results. Castings up to 3,000 pounds had proved water-tight under a pressure of 150 pounds per square inch.

In the afternoon the visitors were taken through the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company. At 8 p. m. a theatre party for the ladies and gentlemen was held at Keith's.

THURSDAY, OCT. 2.

The last meeting of the Institute of Metals Division for this year was held at the Ritz Carlton Hotel and the following papers read:

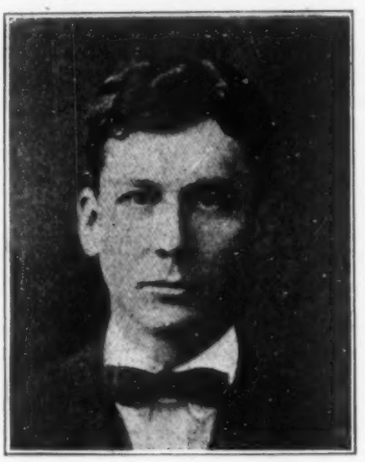
Constitution and Metallography of Aluminum and Its Light Alloys with Copper and with Magnesium, by P. D. Merica, R. G. Waltenberg and I. R. Franman, Jr.

Heat Treatment and Constitution of Duralumin, by P. D. Merica, R. G. Waltenberg, and H. Scott.

Heat Treatment of Aluminum Alloy Castings, by Zay Jeffries and W. A. Gibson.

Mechanical Properties and Resistance to Corrosion of Rolled Light Alloys of Aluminum and Magnesium with Copper, with Nickel and with Manganese, by P. D. Merica, R. G. Waltenberg, and A. N. Finn.

Deterioration of Nickel Spark-Plug Terminals in Service, by H. S. Rawdon and A. I. Krynitzky. Illustrated by lantern slides.



C. H. MATHEWSON, VICE-PRESIDENT, YALE UNIVERSITY, NEW HAVEN, CONN.

Grain Growth in Alpha Brass, by F. G. Smith.

ENTERTAINMENT.

One of the pleasant and also interesting features of the convention was the large number of entertainments arranged for. In addition to the launching and theatre party already mentioned, there was a golf tournament at the White Marsh Valley Country Club.

The ladies' entertainment was in charge of a Ladies' Committee under Mrs. Caroline Devlin Begley. They were taken to Valley Forge, conducted through the Wanamaker store, the plant of the Curtis Publishing Company, Independence Hall and other points of interest in Philadelphia.

In addition there was, of course, the Annual Banquet, followed by dancing. The speakers were Hon. James M. Beck and Sir Ellis W. Hume-Williams.

As we look back upon it we can say that it was an excellent convention excellently managed. The Keynote was reconstruction and production. Everybody was alive and eager to push work to the utmost. It presaged a year of unusual prosperity.

THE CONVENTION OF 1907.

The location of this year's convention brings to mind

that the very first meeting of the American Foundrymen's Association was held in Philadelphia in 1896, also that the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers was first organized in Philadelphia in May, 1907, and was then called the American Brass Founder's Association. The first officers were: President, Charles J. Caley, Secretary, Andrew M. Fairlie, Treasurer, John H. Sheeler. The vice-presidents included William R. Webster, Walter C. Allen, W. R. Park, W. L. Abate, Granville W. Wright, W. M. Corse, J. N. Gamble, Nathaniel K. B. Patch, J. R. Meadowcroft. The nominating committee who named the first officers consisted of the following: Palmer H. Langdon, Henry O. Evans, W. R. Webster, R. Marshall, August A. Miller, Charles H. Proctor, and J. F. Webb. The first enrollment mustered twenty-nine members. Richard Moldenke, who was for a number of years secretary of the American Foundrymen's Association, was instrumental in establishing the then new Brass Founders' Association, which was to be a branch of the iron foundrymen. After a few years under its first title the membership decided in 1912 that the designation of American Brass Founders' Association was not broad enough and the name of the society was changed to the American Institute of Metals—a similar organization having already been formed in Great Britain, entitled The Institute of Metals. In the year 1918 The American Institute of Metals was merged into the American Institute of Mining and Metallurgical Engineers under the special classification of the Institute of Metals Division.

GROUP OF PARSONS' MANGANESE BRONZE PROPELLERS FROM THE FOUNDRY OF WILLIAM CRAMP & SON'S SHIP & ENGINE BUILDING COMPANY, PHILADELPHIA, PA.

MINERAL PRODUCTS OF THE UNITED STATES

The magnificent record of over $10,000,000,000 in mineral output by the United States for the last two years is indicated by preliminary estimates of the United States Geological Survey, Department of the Interior, Washington, D. C., for 1918, combined with known final figures for 1917.

These estimates show that the output of metallic products, chief of which are pig iron, copper, ferro-alloys, lead, zinc, gold, silver, and aluminum, was valued at over $1,895,000,000 in 1918, against $2,091,825,000 in 1917, and that the nonmetallic products, principal of which are coal, petroleum, clay products, cement, and natural gas, were valued at over $3,265,000,000 in 1918, against about $2,889,000,000 in 1917.

The total for 1918 including unspecified products is roughly estimated by the Survey at $5,160,000,000, a good increase over the total of nearly $5,011,000,000 for 1917 and a vast increase over $3,513,972,000 for 1916.

ERRATA

In the rush of going to press in time for the convention, two typographical errors slipped into our September issue. The photograph on page 404, which was marked Corner of Foundry of the J. W. Paxson Co., Philadelphia, Pa., is really the center bay of the propeller foundry of William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa. On page 409 the photograph marked Corner of Foundry of J. W. Paxson Company is really the foundry of Thomas Saville, 1310 Wallace Street, Philadelphia, Pa.

CONCRETE FOUNDRY MOLDING FLOORS

ABSTRACT OF A PAPER PRESENTED BEFORE THE FOUNDRYMEN'S CONVENTION AT PHILADELPHIA, OCTOBER 1, 1919

BY HUTTON H. HALEY, NEW YORK

FIVE BASIC FEATURES.

The five basic mechanical features of a successful foundry may be analyzed as follows: (a) Good, firm, level and clean floors; (b) well prepared molding, facing and core sands; (c) the best of pattern and flask equipment; (d) efficient mechanical molding devices and equipment; and (e) correctly proportioned casting metals. Each plays its part, has its function to perform and contributes to the sum-total result.

There exists in the minds of many foundrymen a misconception regarding the practical use of concrete for foundry molding floors, although it is generally agreed among the users of this material that it surpasses other forms of pavement. No pavement is perfect, yet all have merit, concrete seeming to possess the fewest deficiencies.

The four most common objections to the use of concrete may be summed up as follows: First, spattering or "popping" of molten iron spilled from the ladles may occur where concrete floors are used. This is caused from an almost instantaneous generation of steam when the molten metal comes in contact with the concrete, which is more or less moist at all times. An explosion follows and particles of red-hot metal are apt to fly 5 or 6 feet, in all directions, resulting in painful burns. Occasionally such an accident has been responsible for loss of eyesight. This complaint may be entirely overcome by properly finishing the surface of the concrete floor, as described later.

The second objection lies in the crumbling and breaking down of concrete floors due to general weakness in design, faulty aggregate composition, insufficient curing when green and disintegration from violent expansion and contraction caused from the piling of very hot castings on the concrete floor after a shake-out. All these complaints may be automatically corrected in newly laid floors if the specifications and directions given in this paper are followed.

The third objection, of which less is heard, is the likelihood of tripping and falling over small iron balls of iron or shot, formed from ladle spillage. This objection may be overcome by properly roughening the wearing surface of the floor.

The fourth objection to concrete for molding floors is found in the somewhat exaggerated claim that molders voice discomfort while working on it. Any solid pavement permits a pounding shock, as we walk over it. This is transmtted all though the lower extremities of the body, and results in minor physical injury, producing slight leg and hip fatigue and dull pains or soreness in the instep and leg muscles. Usually it is from molders who are unaccustomed to working on concrete floors that the complaints come, and then only for a short period until their muscles harden. We are all of us accustomed to pavements, and granting as we must, that the result is not entirely satisfactory in this one physical sense, yet we find their combined benefits eclipse this one disadvantage, and so it is or should be in the foundry. None of us would consider dirt walks or streets, nor would a foundryman who has experienced the results from a good concrete floor return to clay or sand floors. It would perhaps be of benefit and but little trouble and expense, to make a die and cut out full soles from a cheap grade of rubber, attaching them as often as required to the molders' shoes.

ADVANTAGES OF CONCRETE FLOORS

A concrete floor has the advantage of presenting a clean and dry surface thereby preventing pneumonia and chronic rheumatism, especially during the winter season, when sand and clay floors are apt to be continually damp, cold and frequently full of frost during the forenoon. There are not a few such floors, built over boggy land, which have induced a high mortality rate.

The results to be gained from paved foundry floors are genuinely worth while. For instance a foundry in Toledo found after careful time studies that it would be possible to reduce the casting losses and improve the quality of the output by the installation of a pavement on which the molds would rest firmly and evenly. A brick floor was installed and the result was approximately a 5 per cent gain, divided between reduced losses and increased production. Level molds are an advantage not to be lightly overlooked in these days of intricately cored, difficult, thin-walled, delicately sectioned castings. Also such a pavement provides a mechanical guarantee and eliminates the human element which must otherwise be depended upon to level each mold set down on the usual irregular sand or clay floor.

Brick pavement is not recommended, as its structure deteriorates much faster than concrete. Furthermore, it breaks down on the edges, forming holes, and is disagreeable to shovel on. A Belgian sawed block, set on concrete, makes a splendid floor but it very expensive.

In a general way it may be said that the use of concrete for floors, pits, foundation walls, etc., is not thoroughly understood by the average contractor. The unsatisfactory results so frequently experienced from concrete floors, leaky pits, cracked masonry, etc., arises from the ignorance of those having the preparation, laying and curing in hand, or in attempting to hasten the completion and use of the structure.

Prepared pavings, such as brick, wood block, etc., are scientifically manufactured to set standards and identical results, under average conditions, may be anticipated and guaranteed from Maine to California. With concrete, the conditions are different. The Portland cement itself is standard, but it forms only a small percentage of the total aggregate which is composed of rock, gravel, sand and water. Each plays an important part in the finished result. Being bulky, the coarse aggregates must be secured locally, each varying, as is to be expected, in quality, structure, etc., according to origin. The preparation of the mixture, a highly important and little understood factor, is too often supervised in a careless manner or by a person who possesses experimental ideas of his own, and in consequence the result is apt to be unsatisfactory.

A SPECIFICATION FOR MOLDING FLOORS

The data given in the following are based upon practical experience rather than theory, and it is hoped this paper will be of benefit and may bring fourth voluntary reports from foundrymen and foundry engineers who may see fit to adopt its suggestions.

The first thing to consider is a specification for concrete molding floors. This specification is as follows:

A concrete mixture is composed of three prime

elements: Portland cement, fine aggregate and coarse aggregate. The proportions are always referred to in the order given above, as 1:2:3 mix, which is composed of one (1) sack of Portland cement, two (2) cubic feet of fine aggregate and three (3) cubic feet of coarse aggregate. A cubic yard of concrete in place shall contain not less than six and eight-tenths (6.8) cubic feet of Portland cement.)

Subbase.—Concrete floors laid over ground having soft spots or on boggy ground should in the first instance have the soft spots dug out and filled, and in the latter instance the entire ground covered or filled with from 3 inches to 5 inches of gravel, crushed slag or steam coal cinders free from particles of unburned coal, soaked thoroughly, tamped and rolled into an unyielding mass. It is important this subbase be well soaked immediately prior to placing concrete thereon.

Thickness.—With proper subbase a 3-inch concrete floor will suffice for light and medium heavy work. For heavier work and over boggy and sloppy land a 4-inch floor is recommended. For heavy-work center bay floors the thickness should be increased to 5 inches. A foundry melting floor should always be one course, that is, laid solid to the thickness desired in one operation without a second finish coat.

Fine Aggregate.—Fine aggregate shall consist of natural clean sand or screenings from hard, tough rock or gravel which, when dry, will pass a No. 4 wire mesh screen.

Coarse Aggregate.—This shall consist of clean, hard, tough crushed rock or pebbles graded to size and shall contain no soft, flat or elongated particles. The size shall range from three-quarters (¾″) inch maximum for a 4-inch or 5-inch floor down to one-half (½″) inch maximum for a 3-inch floor. Limestone and shale should be avoided if possible as the structure of either is none too good. New England trap rock surpasses all other stone for coarse aggregate and where the freight rate is not prohibitive its use is recommended.

Coarse Iron Aggregate.—This aggregate should be composed of cast-iron borings, preferably from cylinder, piston or similar iron. These borings contribute a bonding strength to the concrete and form avenues for the absorption and escape of excessive heat from hot metal spillage and the piling of hot castings on the floor, thereby preventing undue expansion and contraction of the concrete and consequent deterioration. This iron aggregate may be extended all through the entire molding floor with very beneficial results if desired, in which even only 10 per cent (10%) by volume of the total concrete mix need be borings, except for the gangway where the borings should be increased to 2:1:3 of borings, or a 1:1:1 mixture plus 1 of borings. In the event only the gangway aggregate is to be treated with borings, it should be amply deep to provide for laying hot castings thereon.

Machine Mixing.—The ingredients of the concrete floor shall be mixed to an even consistency in a mechanical batch mixer of improved design and mixing shall continue for at least one minute, preferably somewhat longer, after all the materials are in the drum. Raw materials shall not be permitted to enter the drum until all the material of the preceding batch has been discharged. It is impossible to secure an even, thorough, homogeneous mix by hand methods, which should never be attempted.

Retempering.—Retempering of unused concrete which has partly hardened; that is, remixing with or without additional materials or water, shall not be permitted under any circumstances. Such material shall be discarded.

Water.—Use the smallest quantity of water which will produce a workable mix. It is highly important that the proportion of water in the concrete mix be too little rather than too much. A normal plastic workable 1:2:3 mix should present what is termed a quaky state, to secure which the average minimum water per sack of cement used should run five and one-half (5½) gallons to not more than six (6) gallons. The function of water in concrete is two-fold: (1) To supply the water necessary for hydration of the cement, and (2) for the purpose of producing a plastic mix. The influence of the water-ratio on the strength of concrete may be readily understood when by way of illustration it may be said that one pint more water than necessary to produce a plastic concrete in a 1:2:3 mix, for example, reduces the strength to the same extent as though 2 to 3 pounds of Portland cement were omitted from a one-bag batch. The reason that a rich cement mixture gives higher strength than a lean one is not that more cement is used, but because the concrete can be and usually is mixed with a lower water ratio in the case of the richer mixture. In general it will not be feasible to use concrete of a consistency which will give the maximum strength, since it is somewhat too stiff for satisfactory working. Hence some sacrifice of strength is necessary in order to secure a workable mix. It is urged that the water content here specified be not exceeded for foundry floors.

Placing.—Before placing concrete thereon the subbase should be thoroughly soaked. After mixing the concrete shall be handled rapidly and in successive batches, within thirty (30) minutes after water has been added to the dry materials, and shall be deposited in a continuous operation completing (when laid in slab form) individual sections to the required length and depth without stoppage for any cause. Any excess of concrete over that needed to complete a section, at the stoppage of work, shall be discarded and not used under any circumstances. In no case shall concrete be deposited upon a frozen subbase nor shall a completed green floor be exposed to freezing weather without tarpaulin, canvas or some other such protection spread over it.

Forms.—All wood forms shall be thoroughly cleansed of old mortar and dirt and wetted. Metal forms should be coated with oil, soft soap or whitewash before depositing concrete against them. It is undoubtedly a mistake to use the individual slab practice, with expansion joints for a molding floor. The edges of slabs whether rounded or square will in time break down. Once concrete suffers a bad hole or crack it deteriorates at that point in a manner similar to a tooth with perforated enamel.

Expansion Joints.—It is recommended that no expansion joints be provided in the finished floor, the concrete in forms being struck off level with sharp edges; the forms removed when the concrete has hardened to the point where there is no danger of a slump, and the sides so exposed well roughened in order that when the concrete in the adjacent slab is laid thereto it will thoroughly knit into the roughened surface provided. To assist in perfecting a knit it is well to brush the roughened surfaces with a mixture of neat cement grout of a creamy consistency just previous to placing the fresh concrete against the side surface of the preceding slab which has been so prepared. Grout should not be used after it is 45 minutes old. Special pains should be taken to eradicate any

surface seams, crevices or edges as the floor is bound to be weak and subject to disintegration at such points.

Finishing.—When finishing a concrete molding floor to be terminated at the gangway wherein wood block are to be installed, the edge of floor should be finished off with a light angle iron, the web of which should equal the thickness of the floor, pressed or embedded firmly into the concrete as a curbing. In a strictly slab floor, not reinforced, the limit is 100 square feet. In a continuous foundry floor where the forms are used rather as a convenience while placing the concrete and to provide for the immediate contraction during setting, the slabs may be increased into whole sections sized conveniently, it only being necessary to complete each section through continuous operations without any stoppage of work for any cause.

The finishing and curing of a concrete molding floor is of prime importance. After placing the concrete it should be struck off with a sweep or strike-board to the established grade of the forms. Further working should be avoided; the wood float or trowel being absolutely taboo. The surface MUST NOT UNDER ANY CIRCUMSTANCES BE TROWELED OR FINISHED SMOOTH. When the floor has set to a consistency of stiff putty and will show no slump, a long-handled hand roller, having parelled or checkered corrugations three-eights (⅜") inch deep and of sufficient weight to make full indentations in the concrete surface should be passed over the floor and gangways. These indentations will hold sufficient sand to prevent popping of molten iron when spilled on the surface of a concrete floor so finished, even though the floor be swept. Furthermore, the indentations provide nests to collect and hold the shot iron which are apt to throw workmen.

Curing.—Perhaps the greatest cause for the failure of concrete floors may be traced to the entire lack of or insufficient curing of newly laid green material. All forms of concrete show great increases in strength under favorable curing conditions as compared with specimens which have been allowed to air dry. In arid regions and during warm weather freshly laid concrete is exposed from the moment it is laid to rapid evaporation of the mixing water. Therefore the chemical action in process during "setting" is retarded and only a portion of the strength is secured. Concrete floors of any character should be covered with sand, shavings, saw-dust, or some such material as soon as the floor has set to a consistency which will permit the placing of such a topping, which in turn should be soaked twice daily. A 21 to 30-day storage is apparently about the ideal length for the best curing results, as by the expiration of these time limits the strength and wearing qualities will have increased some 150 to 200 per cent over the original strength of the same floor allowed to air dry. It is urged that every concrete floor be cured at least 10 days, the very minimum being three days.

The use to date of prepared wood-block for molding floor gangways, under the cupola spouts and on charging platforms has met with splendid success. The spillage of iron on wood blocks merely chars it slightly, molding sand filling in the char holes and preventing further burning.

Aside from the first cost of wood blocks, which must themselves be laid on a concrete foundation, this form of pavement for a molding floor seems quite ideal except perhaps in foundries running string sand floors, such as stove shops, where the molder's shovel comes in contact with the floor continually. It is thought the slight projections of the corners of the blocks may present a roughened surface to the shovel and annoy the molder.

In conclusion, the author wishes to acknowledge his indebtedness to Prof. Duff Abrahams, Lewis Institute, Chicago, and the Portland Cement association.

THE SEPARATION OF BISMUTH FROM SUBSTANCES CONTAINING BISMUTH AND COPPER.

"Metall. und Erz" describes a method for extracting the bismuth contained in the waste lead of intermediate and by-products, or in copper slag, the flying dust of copper converters and the anode sludge from lead electrolysis, after the arsenic, antimony and lead have been removed in the form of antimony-arsenic-lead oxide slag. It is based on the fact that a greater affinity exists between sulphur and copper than between sulphur and bismuth. The process is carried out by first mixing the starting substances with alkaline sulphur compounds and then melting them to obtain crude bismuth and copper matt, the latter being subsequently worked for copper, whilst the crude bismuth is subjected to a further elec-electrolytic treatment.

The most suitable alkaline sulphur compounds for the purpose of this process are alkaline sulphates—not alkaline sulphides, as the latter melt too easily and are, moreover, too hydroscopic. The reduction to sulphides is effected by the aid of either coal or coke; both the sulphate and the coal or coke must be in excess, to ensure that all the copper present is converted into cupric sulphide.

The process may be carried out either in a blast or a reverberatory furnace, the most suitable temperature being between 1,370 and 1,650 degs. C. The operation is completed when the bath ceases to simmer and gases such as carbonic oxide are no longer evolved. When that is the case there will be found in the furnace three different layers of products which can be easily differentiated from each other. The first layer is composed of soda slag and consists of a mixture of sodium sulphide, sodium sulphate, caustic soda, etc. Beneath there will be found a layer of cupric sulphide, and finally, at the bottom, a layer of bismuth, nearly all of which will be in a metallic state.

If silver and gold are present in the starting substances about 80 per cent. of the silver and nearly all the gold will be found in the bismuth collected at the bottom, and can then be recovered during the electrolytic treatment of the bismuth. The remaining 20 per cent. of the silver will be found almost entirely in the cupric sulphide; the amount mechanically retained by the sodium slag being exceedingly small.

Any antimony or arsenic contained in the starting substances will be found in the layer of sodium slag in the form either of sodium arsenate or arsenite or of sodium antimonate or antimonite. Any traces of either arsenic or antimony which have passed into the crude metallic bismuth can be completely recovered by the subsequent electrolyte treatment.

Any tellurium that may be present can always be recovered from the copper, with which it will form a mixture of cupric sulphide and copper telluride. Of the lead which may be present about 40 per cent. of its entire mass will be found in the sodium slag, about 10 per cent. in the cupric sulphide and the remaining 50 per cent. in the crude metallic bismuth, from which it can be recovered in the well known manner during the subsequent electrolysis.

The Foster Brothers Mfg. Co., Broad street, Utica, N. Y. manufacturers of iron and brass beds, is building an addition to its four-story plant to cost about $10,000, which will include a tool room, japanning, polishing and lacquering de-departments.

THE ELEMENTS OF ELECTRICITY AS APPLIED TO ELECTRO-PLATING*

By Floyd T. Taylor, General Manager, A. P. Munning Company, New York.

Let us outline a few of the simple, basic facts of electricity then show how they apply to plating. After that let us take up one or two of the laws, and then come down to practice, spending a few moments on generators, rheostats, meters and bus bar systems.

As this is to be an after-dinner talk, not a week-end party, we cannot go into things deeply or at great length, but I shall be glad to answer questions in an after-session and do whatever I am able to do to leave with you information that is, at least, correct.

At the very outset let me explain a much-misunderstood word. I refer to the word theory. There has always been a certain mystery around the word theory and the common idea is that it frequently differs from practice. Truly a theory is only a general explanation of definite and specific facts, and therefore when it fails to explian all the facts in the case, it has to give way and ceases absolutely to be a theory. It isn't even a " has been"; it is a "never was" the minute and single fact is discovered that it fails to explain completely. Some of the world's strongest notions have had to give away—for example, that the earth was the center of the universe. Take electricity as an example; it has often been likened to the flow of water, a simple way of explaining some of its actions, and as such, was spoken of as electric fluid or "juice." But it is not a liquid because it possesses no weight, and it has a double existence, positive and negative, which is distinctly unlike the properties of fluids.

This explanation of theory is made at the outset because it is so often stated by careless talkers and thinkers that "the theory may be all right but it does not work out in practice." We often misinterpret facts; often with the best of intentions mistake them. Theories, however, which are the work of the best brains of the world, aided by the great modern fund of stored knowledge, are rarely wrong these days and I doubt seriously if the world will ever see again a theory upset or changed. Believe in them because they will often times show quickly that you are misjudging facts and they will point the way to correct methods, saving you unbounded loss of time and effort in the fruitless search of the man without any knowledge of the theory of it all.

After such an outburst on theory you might expect that I will state the theory of electro-plating, but such is not to be the case, because the last word I heard on the subject is that up to date there is no theory—the facts of electro-plating, that is, of electrolytic dissociation, are not known well enough nor for a sufficient length of time to make it possible to state the theory of it all. There have been numberless attempts, but no theory.

There are, however, some laws or relations that are well known and these will be pointed out.

We can divide the subject of electricity into a great many branches. Purely for convenience and without discussing the merits of the rights or wrongs of the case, let us select, for the present, two divisions—static or stationary and dynamic or moving (think of dynamite).

Under static electricity we have the so-called charges —positive and negative—and electricity was discovered as far as we know in this form, by Thales of Miletus about 600 B. C., who found out that when amber was rubbed it would attract small light bodies. Apparently the discovery did not attract much attention, because it was not until a thousand years later that history records anything else about the subject and then a Dr. Gilbert found out that many substances acted the same as amber when rubbed. It was even later that the discovery of the two kinds of static electricity was made, and our own Benjamin Franklin applied the names positive and negative to the two kinds. Now of course you know that all through electricity likes repel and unlikes attract, also that all actions and reactions are equal in force and opposite in direction. In the electrification of a solution, it is probable that the chemical atoms composing the solution are first charged, some of them positively and some of them negatively, and that they perform all of their evolutions as a result of these charges. In this way electrolysis is very similar to the static electricity with which all of you are more or less familiar. Faraday was the pioneer on the subject of electrolysis and it might be well to state the two laws which he has given the world on the subject: They are as follows:

First Law: The quantity of an electrolyte decomposed by the passage of a current of electricity is directly proportional to the quantity of electricity which passes through it.

Second Law: If the same quantity of electricity passes through different electrolytes, the weight of the different ions deposited will be proportional to the chemical equivalents of the ions.

Let us pause a moment and define a few terms. You know that in electrical language the ampere is the unit of current, the volt the unit of electrical pressure, the ohm the unit of electrical resistance. These are the three fundamental units, just as length, mass and time are the three fundamental units of mechanics.

Now Faraday says the quantity of electrolyte decomposed is dependent on the quantity of electricity which flows and the unit of quantity, that is, the amount of electricity obtained when one ampere flows for one second is called the coulomb. There is, then, a definite relation between coulombs and weight of solution decomposed and in the second law the relation is explained, namely in proportion to the chemical equivalents of the ions. Now we have two new terms to define—chemical equivalent and ions. The chemical equivalent is the quotient of the chemical atomic weight divided by the valency of the chemical element under discussion. One explanation is growing more involved because in an effort to explain the meaning of one unknown term, we have made use of two names of something which ought to be explained; but that is the way of science, all branches are inter-connected so that often-times electrical development, for example, had been compelled to wait for chemical development, and vice versa. Astronomy did not come into its own until optics and mechanics had perfected the means of observation needed. But to go back, the smallest particle conceived by the old-fashioned chemist was the atom; that was the last word, so to speak, of the division of matter. Now, however small a particle of matter is, it has weight; hydrogen being the lightest atom known, its weight was taken as one—and as oxygen was found to be sixteen times as heavy its atomic weight is of course sixteen. By various methods all the atomic weights were determined and recorded. It was likewise discovered that chemical atoms had another property—namely: They did not all combine with each other in equal quantities; that is, atom for atom. For example, one atom of oxygen would combine with two

*From The Monthly Review, Electro-platers' Society.

atoms of hydrogen to form water; hence this power of combination had to have a name, and is called valency —with hydrogen again taken as the unit; that is atomic weight one—valency one. Going back, then, we have chemical equivalent defined, so that it only remains to be remembered that electro-chemical equivalent, which is the term that really interests us, is the electro-chemical decomposition of a solution as compared with the electrical liberation of hydrogen from a solution. For example, the atomic weight of hydrogen is one, its valency one, chemical equivalent one, electro-chemical equivalent in grammes per coulomb is .00001-038—nickel, atomic weight 58.6—valency 2—therefore chemical equivalent 29.3 and electro-chemical equivalent .0003034, which is 29.3 times as great as the electro-chemical equivalent of hydrogen. These things are pointed out to you at length to show that in electro-plating definite relations exist; they are not so very complex and there is no reason why there should be any great mystery in the art.

We must now define the word ion. In chemical language the atom, as has been stated, is the smallest unit, but in electrochemical language we have half-atoms, so to speak, because atoms when charged with electricity are said to be ions and we must have positive ions or cathions, and negative ions or anions. The cathions are those, then, that are positively charged, hence move from the anode toward the cathode, where in electro-decomposition they give up their charge and are thrown down or, as I prefer to think of it, electrically welded onto the cathode.

Next let us take up the Ohms Law; that is, the relation which exists throughout electricity between the unit of current, or ampere, the unit of pressure, or volt, and the unit of resistance, or ohm. The law states that the current which will flow in a circuit is equal to the quotient obtained by dividing the voltage by the resistance. We can state the relation in a number of ways, but the important thing to remember is that in any circuit there is always a definite, fixed and invariable relation between these three quantities, namely: the current, voltage and resistance. The law is usually written $I = \frac{E}{R}$ where I is the current in amperes, E the voltage in volts, and R the resistance in ohms. Notice what the equation means in a plating circuit. Suppose we have 100 amperes flowing in the circuit and 6 volts at the generator terminals; then the resistance in the circuit, that is, the resistance of the bus bars, lead wires, joints, rheostat, and plating solution itself all added together is .06 ohms—no more and no less. Now, suppose the voltage across the work is 3; in such a case the resistance of the anodes, the work, and the solution added together, when this same 100 amperes flows is of course .03 ohms. Recollect that to get more than 100 amperes to flow under such conditions we can do one or both of two things—either raise the voltage across the work or decrease the resistance of the work, anodes and solution. We can raise the voltage across the work either by raising the generator voltage or by lowering the loss in voltage in the bus bars or rheostat between the generator and the work. We can decrease the resistance at the tank itself by increasing the surface of the work, by increasing the anode surface, by lessening the distance between the anodes and the work, or by decreasing the resistance of the solution itself. There is no other way of changing the current that will flow. Notice, however, that the amount of current that will flow is in exact proportion to the voltage behind the current and in so-called inverse proportion to the sum of all the resistances of the circuit. Resistances once fixed in a plating circuit are usually fairly constant but the voltage regulation of ordinary plating dynamos is very far from it. A change of voltage of 10%, that is, .6 volts on a 6-volt machine means a change of 10% in the rate of plating. Ohm's Law can also be written $R = \frac{E}{I}$ and $I R = E$, which are merely different forms of the same relation. From this law we can easily calculate resistances by measuring the current in a circuit and the voltage across the ends of the resistance in question, then put the values into the most convenient form of equation, knowing two, we can solve for the third. The value of any number of separate resistances in series is the sum of the separate resistances. If we want to know the value, however, of a network of wires in multiple, as it is called, for example, a special bus bar system or a rheostat made up of parallel coils, we can calculate the so-called resultant resistance by a formula which I will merely state without taking the time to explain in detail. It is as follows:

Let R0 equal the resistance we want to know, and R1, R2, R3, etc., the resistance of the separate coils or length of bus bars; then $\frac{1}{R0} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$ etc. Remember this formula as it explains the increase and decrease of resistance in a parallel circuit, and when you put work into your tanks you are creating a parallel circuit, increasing the parallels as the work in the tanks is increased and vice versa. Thus, as the area of work is increased the effective resistance of the solution is lowered; hence, with the voltage maintained by the generator, the current taken by the bath increases with the increase of work. It is doubtful if the average person in the plating room understands this fact; or if he does, it is not with a clear knowledge of the reason.

There is one other law or relation that ought to be brought out, because it leads us on to another link in our chain. In machines we know that the amount of power is always the product of the pressure and the volume. Similarly in electricity the power is the product of the pressure and volume or, as we say, volts times amperes; that is, E I. Referring to Ohm's Law we have $I R = E$ as one of the relations that must always exist in an electrical circuit carrying current. Hence we can substitute the value of E from Ohm's Law in our Power Law, which gives $I \times I R = W$; or, as we say, $I^2 R =$ Watts. Now, the important things to note in connection with this law are these: All power is divided into useful power and lost power, but the formula for calculating either the useful power or the wasted power is, of course, as just stated. Next, in plating circuits, where we are always dealing with large currents, the losses may be very severe, due to the fact that our formula requires us to multiply by the current twice and the resistance once. We cannot escape the large currents; they are one of the requirements and as already explained in connection with electro-chemical equivalents fixed in relation to the amount of solution decomposed. It is important, therefore, to keep down the resistances of the plating room circuits and to keep up the conductivity of solutions.

Our next link is that of efficiency, a word which has been abused, misused and misunderstood. We shall only touch on electrical efficiency, after giving a general definition of what it really is. The efficiency

of anything is the ratio of what you get out of a thing to what you have to put into it for the output demanded. Stated another way, it is the in-put minus the losses divided by the in-put. It is evident, then, that the losses determine the efficiency, and that to raise the efficiency of any machine, system or operation we must lower the percentage of the losses.

We will not attempt to state where the various losses are in a plating room, except as we come to them in the discussion of the generator, rheostats and bus bars, to which we must now pass on.

The facts which I will give you on generators are taken from THE METAL INDUSTRY, July 1917 a paper which I read at your last annual convention in St. Louis. There are two reasons for such a course; first, because facts do not change; and second, because I have not yet discovered a clearer method of bringing out the principal points in connection with generators which, in my judgment, platers ought to know.

The principal types of generators are named from their field windings and are three in number: the shunt generator, the compound generator, and the inter-pole generator.

The shunt generator has a single set of field windings connected across the brushes or its equivalent. It is the simplest form of a generator and would be used universally if it had the property of maintaining its voltage regardless of the variation of load in the tanks. Unfortunately it cannot hold its voltage constant and therefore the compound-wound generator was developed to overcome the defect.

The compound-wound generator is a shunt-wound machine, with the addition of an extra set of field windings, in series with the armature. With such a machine the magnetic field strength is varied with the load and if the various proportions are correctly worked out, it will maintain an almost constant voltage throughout wide fluctuations of load.

The inter-pole generator is usually a compound-wound machine with the addition of an extra set of poles spaced midway between the main, or regular, poles, and each of these extra poles carries a field winding, also in series with the armature. It is, therefore, the most complicated type of generator as far as windings and parts is concerned. The inter-pole generator was developed for the purpose of bettering the commutation of machines which without a compensating winding might be so poor in electrical design, through skimping of material, as to be entirely unsatisfactory. Within certain limits the use of the inter-pole results in a smaller and cheaper machine, the danger of its use is that ordinarily too much reliance is put on corrective value of the inter-pole. Its proper sphere is for high-voltage, high-speed machines, and for conditions which are very different from those in a plating room.

Whether the shunt, compound or inter-pole generator is best for plating work is, however, still a matter of opinion; that is to say, we can still debate, if we think it worth while, on the merits of the simple shunt machine or the inherent drawbacks of the complicated and tricky inter-pole.

Plating generators are either self-excited or seperately excited. The self-excited machines are simpler and, in the smaller capacities, preferable. In larger sizes, that is to say, 2,000 amperes and upwards, separate excitation is better general practice. Remember also that separate excitation is a powerful tonic for a weak and poorly designed machine.

The various parts of a generator are probably so well known that it seems useless to name and describe them all. There are, however, points that ought to be brought to your attention. First, the brushes, brush-holders and commutators taken as a unit, because a plating generator is really principally a device for collecting a large amount of current and passing it on to the bus bars and tanks. The brushes then should be reasonable in number and size, of such material as to require a small amount of attention. The brush holders must be rigid but not clumsy and of a type that cannot allow the brushes to get out of line. They must also be quick acting, so that the brushes will follow the commutator absolutely. The commutator itself must be of drawn or hammered copper, must be insulated with a very good grade of soft white mica, and on the larger size machines care must be taken to support the segments in such a way that they do not loosen as a result of repeated heatings and coolings.

All plating generators should be insulated throughout with either mica or moulded materials, not for 6 or 12 volts, but for protection against possible external grounds, and such insulation is entirely possible.

Naturally the machine should be of simple mechanical design, accessible for cleaning and easy to understand, with the fewest possible number of parts, especially electrical joints in the path of the armature current.

Voltage regulation is important because you set your plating conditions with the expectation of a constant source of power, and therefore without it accurate and precise work is out of the question.

If a generator is efficient it must be well designed and therefore it will be a good machine from an operating standpoint. Efficient dynamos are also desirable on account of the substantial savings in power cost between the efficient and inefficient machine.

Recollect these two points on the efficiency of plating generators—the brush losses are usually more than half the total losses of a plater and as they are in the neighborhood of 15% of the input, the maximum possible efficiency of the average plating machine is less than 85%. A machine giving an efficiency of as much as 80% would be radically different from any of the prevailing types.

In passing it should be mentioned that the efficiency of a motor generator set is the product of the efficiency of the motor and the generator and is therefore always less than that of either the motor or generator considered separately.

Leaving the generator we come to meters. You all know the difference between a voltmeter and an ammeter; know in general how they are made and the principles on which they act. Therefore, let us pass on with the mere statement that every plating tank ought to be provided with means for reading the current taken and the voltage across the work, otherwise the whole plating operation electrically considered is a guess—just like a chemist working without weights or measures. Maybe he can tell, but he certainly cannot tell much that is useful.

Next rheostats—the tank rheostats. These are of two types, series and parallel. In principle they act in exactly the same way. In practice they require the same amount of resistance material because they have under similar conditions the same amount of heat loss to dissipte. The operation of the series type is more obvious, but the parallel type gives a greater number of gradations of current in proportion to the number of resistance coils and has the added advantage that all its contact resistances are in multiple rather than series, so that it is probably a better type to use. Remember, however, that Ohm's law holds for the relation between

the current, voltage and resistance, in rheostats as well as any other part of an electrical circuit. Consequently statements which seem to indicate otherwise are either not clear or not true.

As the next link in our chain we will spend a moment or two on the subject of bus bars in plating rooms. The simplest system of power distribution is, of course, the two-wire system, where there is a positive and negative bus only. Next, we have the three-wire, where there is a positive, negative and neutral bus, all running back to the dynamo. In this system it should be noted that we have in effect two 2-wire systems with a common wire, that is, the neutral is the negative of one system and the positive wire of the other at one and the same time. Also note that when the load is exactly balanced no current whatever flows in the neutral, hence it might as well be disconnected from the generator and left out as long as such a condition maintains. When the load is out of balance, that is, when the tanks on one side of the neutral are taking more current than are those on the other side, this neutral wire is called on to carry the difference in load of the two sides.

Now I have said that in a 3-wire system all three busses are connected back to the dynamo—in common practice with such a connection we would have a 6-12 volt system. But suppose we want a 3-6 volt system and we have a 2-wire 6-volt generator, why not run a neutral wire back to the generator, then finding no terminal for it, simply remember that if you keep the load balanced it need not be connected to the machine? If you carry out such a procedure, you have the so-called false neutral system. There is nothing mysterious about it, and lighting systems, which are, as you know, very sensitive to voltage variations, have been connected in such a way for many years. There are apparently two reasons why this system is not more largely used in plating rooms. First and frankly, because, electrically speaking, most plating rooms are very crude; and second, because the fear that the load cannot be kept sufficiently well balanced to make the system a success. Those who have tried the scheme usually like it, and as a power-saver, its advantages are beyond dispute—it means that little or no regulation is required of the tank rheostats and that the voltage across the work is steadier than would be the case if 6 volts are reduced to, say, 2½ volts at the tank. Here, then, is one solution of the 3-volt circuit and it is a far simpler and better solution of the problem than the 3-volt dynamo, unless the machine is of the best possible design and materials. It is difficult enough to produce a satisfactory 6-volt machine; a past master is required to design a 3-volt one.

So much for a statement of the bus bar systems. How should the size of the bars themselves be figured? The answer depends on one other question, namely: are you willing to spend an hour laying our your plating room to get the size right once for all time, or would you rather spend 10 minutes in haphazard guessing and let it go at that? Let us assume that you want to make a good job of it. You would then find out how much copper is needed to carry the average current in the various parts of the room, assuming that the cost of power lost in the bus bars themselves to be equal to the interest and depreciation of the copper tied up in bus bars. It is perfectly possible to find such a balance and if the bus bars are so designed, it will follow that enough copper has to be provided to insure good voltage regulation throughout the whole system.

Tables of carrying capacities of wires are very misleading—for example, while in high voltage work 2,000 amperes per square inch can be used on open bus bar work, in plating rooms from 600 to 800 amperes per square inch is more nearly the right value. The principal factors to be considered are the cost of power, the average load in the bus bars, the hours per year that the plant operates, the cost of the copper itself, and the interest and depreciation factor of the plant.

Very naturally you try to locate the generator at the electrical center of the plating room and, equally, all the runs are made as short as possible, but it is essential to select properly the cross section of the conductor.

One other point, the number of joints in the bus bar system should be kept down to the absolute minimum and each joint should be carefully scraped to a fit and soldered or joined with a mercury amalgum. Remember also that the resistance of any joint is always greater than the resistance of an equivalent area of a solid conductor.

Finally, let me state the way to find out the cost of current used in plating, because while the plant engineer knows how to make such calculations the average plater does not, although the method is simple. First, find out the cost of power at the plant switchboard in dollars and cents per K. W. hour. Let us assume the plating room to be supplied by a motor generator set. The cost of current on the plating room bus bars is then the cost at the switchboard divided by the over-all electrical efficiency of the motor generator set. Multiply this value by the total average current taken from the plating generator, then by the voltage, then by the hours per day and the days per year that the plant runs, and you will have the total cost for power used in the plating room per year.

TIME IN HOURS AND MINUTES NECESSARY TO DEPOSIT VARIOUS COATINGS OF ZINC ON ONE SQUARE FOOT OF SURFACE.

Basis of Figures, 1,000 Ampere Hours = 40 oz.

Amperes per Sq. Foot.	1 Test. 1/6 oz. Per Sq. Foot.	2 Test. 1/3 oz. Per Sq. Foot.	3 Test. 1/2 oz. Per Sq. Foot.	4 Test. 2/3 oz. Per Sq. Foot.	5 Test. 5/6 oz. Per Sq. Foot.	6 Test. 1 oz. Per Sq. Foot.
½..	8:16	16:32	24:48	33:04	41:20	49:36
1....	4:08	8:16	12:24	16:32	20:40	24:48
2....	2:04	4:08	6:12	8:16	10:20	12:24
3....	1:23	2:46	4:09	5:32	6:55	8:18
4....	1:02	2:05	3:07	4:10	5:12.5	6:15
5....	:50	1:40	2:30	3:20	4:10	5:00
10....	:25	:50	1:15	1:40	2:05	2:30
15....	:16.6	:33	:50	1:06	1:23	1:39
20....	:12.5	:25	:37.5	:50	1:02	1:15
25....	:10	:20	:30	:40	:50	1:00
30....	:08	:16.6	:25	:33	:41.5	:50
35....	:07	:14	:21	:28	:35	:42
40....	:06	:12.5	:19	:25	:31	:37.5
45....	:05.5	:11	:16.5	:22	:27.5	:33
50....	:05	:10	:15	:20	:25	:30
60....	:04	:08	:12	:16	:20	:24
70....	:03.5	:07	:10.5	:14	:17.5	:21
80....	:03	:06	:09	:12	:15	:18
90....	:02.75	:05.5	:08	:11	:13.75	:16.5
100....	:02.5	:05	:07.5	:10	:82.5	:15

N. B.—Decimals less than one-half have been disregarded in figuring the above time.

One ampere flowing for one minute deposits .000667 ounces of zinc.

ACTIVITIES OF THE BRITISH INSTITUTE OF METALS

A Summary of the Fourth Report of the Corrosion Committee.

By Guy D. Bengough, M.A., D.Sc., and O. F. Hudson, D.Sc.

(Continued from October, 1919)

Part II.—The Corrosion and Protection of Condenser Tubes.

The form of the surface of certain condenser tubes of 70:30 brass has been studied in detail. The presence of a layer that differs in its behavior toward corrosive agents from the underlying metal has been identified in several different ways. In many cases this layer is probably richer in copper than the alloy beneath it. In such cases the tube may resist dezincification in a marked degree for long periods; in other cases the surface layer probably has nearly the same composition as the rest of the tube, and in such cases strong dezincification may take place in the sea-water in the neighborhood of 50° C. Tubes from the same bath of manufacture usually resemble one another as regards the nature and properties of the layer, and tubes from different batches, even though made by the same maker, may differ. Thus an important factor as regards dezincification is the nature of the tube, but the kind of surface that best resists dezincification does not necessarily best resist other kinds of attack. Means of controlling the surface layer have not yet been worked out, but the problem does not appear to be insuperable, and is receiving attention. The condition of the surface layer should be adapted to the conditions under which the tube will be used.

In many cases local action may be initiated on condenser tubes by the action of certain bodies, which themselves appear to take no direct part in the action. Such bodies are sand, calcium carbonate, ferric hydrate, glass, clinker, and coke. The amount of action that takes place varies with the physical properties of the substance. The action is associated with the accumulation of products of corrosion, and may be largely assisted by them. The nature of this action is of well-marked type, and has been provisionally called oxide disintegration. It is usually characterized by intercrystalline oxidation. Actions of this kind are of great importance in many cases of corrosion on the practical scale.

A preliminary study has been made of the action of very dilute acids on copper, 70:30 brass, and Admiralty alloy. The matter is important technically, because supplies of water in certain parts of the country are slightly acid in character. The strength of acids used were between 5 and 10 parts of acid in 100,000 of water. Both HCl and H_2SO_4 were used. Acids of these strengths greatly accelerate corrosion and alter the type of action. The attack of the two acids, even when of equivalent

Causes of Condenser Tube and Ferrule Corrosion. (Water side only considered.)

Cause.	How Produced.	Nature of Action.	How to Be Remedied.
A. Foreign bodies carried in and accumulation of products.	A1. By ferric hydrate flakes from water ends. A2. By ashes, clinkers, etc. A3. By sludge of sorts in water supply.	Complete corrosion of the oxide disintegration type, causing local action.	A1. Paint the pipe line and water ends. Increase water speed. A1, A2, and A3. If worth while trap the water supply or pass it through a screen. In some cases increase water speed.
B. Acid or other bad or variable water supply.	B1. Some river supplies, *e.g.*, Tyne. B2. Some canal supplies, ship canal. B3. Some well supplies. B4. Some estuarine supplies. B5. Some cooling tower arrangements.	Complete corrosion and rapid general thinning. Sometimes slight uniform dezincification.	Keep water supply slightly alkaline. Use special tubes adapted to the special conditions.
C. Temperature in condenser too high.	C1. Hot inlet water, *e.g.*, tropical. C2. Slow water speed. C3. Partial blocking of tubes.	C1. Dezincification. C2. Dezincification. C3. See A3.	C1 and C2. Use special tubes. C2. Increase speed. C3. See A3.
D. Undue aeration.	D1. Errors in pump and pipe line arrangements. D2. Eddies near inlet causing waterline effect.	D1. Complete corrosion of oxide disintegration type. D2. Complete corrosion of pitted areas.	D1. Remedy air leaks, etc. D2. Special ferrules. Possibly increasing speed of water with modified design of water end.
E. Unsuitable composition of tube.	E1. Zinc, or impurities in too great amount. E2. Surface of tube not sufficiently copper rich.	E1. Varies. E2. Dezincification.	E1. In manufacturing. E2. Probably by attention to details of annealing and pickling during manufacture.
F. Defective packing of tubes.	F1. Leaks caused by perishing of the packing material, especially in acid water. F2. Collapsing of tube.	F1. Varies. F2. Varies.	F1. Use good tape packing. Red lead is sometimes useful to prevent leakage. F2. Do not crush tubes when inserting it.
G. Physically bad surface of tube; *e.g.*, bad spills and laminations.	G1. Foreign bodies caught and trapped which would otherwise be swept away.	G1. Complete corrosion and oxide dezincification.	G1. During manufacture.
H. Thermo-electric action in condenser.	H. By steam impinging directly on tubes, or being improperly distributed.	H. Dezincification.	H1. Only occurs in condensers of old design when steam is not properly distributed.
I. Too slow water* speed.	I. Gases given off inside tube and not immediately swept away.	I. Complete corrosion near inlet end.	I. Increase speed of water. Do not use main condenser for auxiliary machinery import.

*See article by W. Ramsey, Engineering, July 17, 1917.

strength, differs both in extent and character, that of HCl being greater and more selective. Admiralty condenser tube was decidedly more resistant than 70:30 brass to the action of dilute acids.

PART III.—PRACTICAL PROBLEMS ON CORROSION.

Part III of the report deals with the subject of corrosion under practical conditions as it appears to the authors. The views expressed are founded upon their general experience both in the laboratory and in connection with working conditions of actual plants. Unfortunately, the conditions in a practical plant are never known in full detail. Evidence as to the cause or causes of corrosion rests on a comparison of the corroded tube with others which appear to be similarly attacked under conditions that are more precisely known. **One degree of probability therefore which attaches to these views must be regarded as lower than that based on conclusions drawn from laboratory experiments.**

The authors express the view that corrosive attack on condenser tubes is more diverse in character and complicated in nature than has been generally supposed. The first action is one of chemical oxidation, and secondary actions are of great importance. No one single remedy is likely to be found effective for all the different kinds of attack which occur in practice. The nature of the tube used and the protective measures chosen should be dependent on the particular set of conditions.

The following is a set of conditions under which a 70:30 brass condenser tube should have a minimum life of twenty years:

(*a*) Only clear water to enter the tube, or water which will not deposit suspended matter.
(*b*) The water must be free from gases in suspension, and must not contain more than the normal amount of air in solution.
(*c*) The water must be neutral or not more than very slightly alkaline. It must be free from ammonia and certain other specially harmful substances, which are, however, of comparatively rare occurrence in technical waters.
(*d*) The temperature of the cooling water in the hottest part of the condenser should not exceed 35° C.
(*e*) The speed of the water should be about 5 or 6 ft. per second.
(*f*) The steam should be properly distributed in the condenser, according to the best modern practice.

A water supply which varies considerably in composition at different times of the year involves special problems and must be excluded from the above statement at present.

In practice tubes fail sooner than the period stated, because the normal slow roughening of the tube by chemical oxidation is locally speeded up by factors which are for the most part independent of the tube. It will be noticed that this way of treating the subject is the inverse of that usually adopted. A preliminary attempt is made to gather the more important of these factors into a tabular statement, which is given above. The statement is to be regarded as a skeleton structure, which will be amended and filled in as experience accumulates.

The effect of the presence of a scale on the rate of corrosion is considered to be of great importance. Of the substances that commonly occur in scale calcium carbonate is one of the most important. Its effect varies with its physical condition. It may exert almost any kind of effect from a considerable degree of protection to a serious attack.

Some observations are described on the effect of a form of electrolytic protection (the Cumberland process) at the Southwick Power Station of the Brighton Corporation, which is under the charge of Mr. J. Christie, who has placed many facilities at the authors' disposal. The conclusion is reached that the process insures a prolonged life for the tubes under Southwick conditions, provided that it is applied to new tubes, *i. e.*, to tubes that have not begun to corrode before the process is in operation. The process should be applied continuously and not intermittently. The authors consider that the thin uniform scale which is maintained on the tubes by the process is an important factor in preventing serious corrosion. One of the important functions of the scale is to prevent contact between the tube and harmful deposits and products of corrosion; in addition it slows down, but does not entirely prevent the general oxidation of the tube. The authors consider that further evidence is necessary before the value of the process can be estimated as regards prevention of corrosion in certain types of water other than sea-water.

EDITORIAL STAFF OF THE METAL INDUSTRY

Louis J. Krom, who has been the managing editor of THE METAL INDUSTRY for the past eleven years, has resigned and accepted a position as works manager with the new rolling mill of the West Virginia Metal Products Corporation, and takes up his new position with the best wishes of THE METAL INDUSTRY. He will continue on the staff of THE METAL INDUSTRY as rolling mill editor.

Mr. Krom is a graduate of Lehigh University, and for ten years was with the rolling mill industry at Waterbury, Conn. He was one of the first chemists to be employed by a rolling mill in that city. While with THE METAL INDUSTRY he was the author of a number of notable papers on metallurgical and rolling mill subjects, which included "The Manufacture of Wrought Brass," "Fluxes from the Viewpoint of the Metallurgist," "The Annealing of Brass Cartridge Cases," "The Development of the Rolling Mill," "The Manufacture of Seamless Tubes," "The Mechanical Tinning of Metals," and "The Manufacture of Tin and Lead Foil."

Adolph Bregman, the new managing editor of THE METAL INDUSTRY, is a graduate of the Colorado School of Mines, and while there specialized in metallurgy. After leaving college he was associated with a number of smelting and refining works, first in the West, and then in the East, and while engaged in his profession of metallurgical engineer made a study of metallurgical furnaces. He is well known to METAL INDUSTRY readers having written a number of articles for this journal, which include The Recovery of White Metals from Drosses, The Manufacture of Soft Solder from Scrap, Metallurgical Furnaces, and Modern Developments in Die Casting.

The editorial staff of THE METAL INDUSTRY will also include the following experts, who will act as associate editors in their respective callings; viz: Jesse L. Jones, Metallurgical; William J. Reardon, Foundry; Louis J. Krom, Rolling Mill; Peter W. Blair, Mechanical; Charles H. Proctor, Plating-Chemical, and Coryden P. Karr, Exchange.

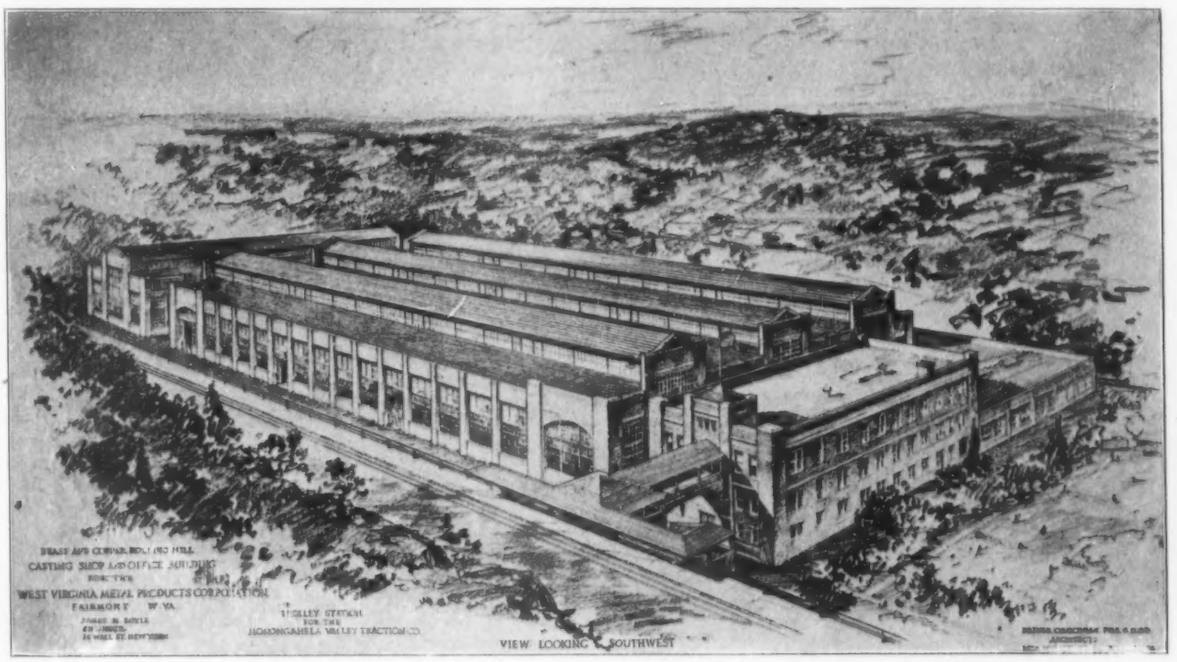
With our editorial battery of experts we can assure the readers of THE METAL INDUSTRY, that our future reading matter will be kept up to the high standard that it has been in the past. In fact we expect to surpass all past efforts.

A NEW WEST VIRGINIA ROLLING MILL

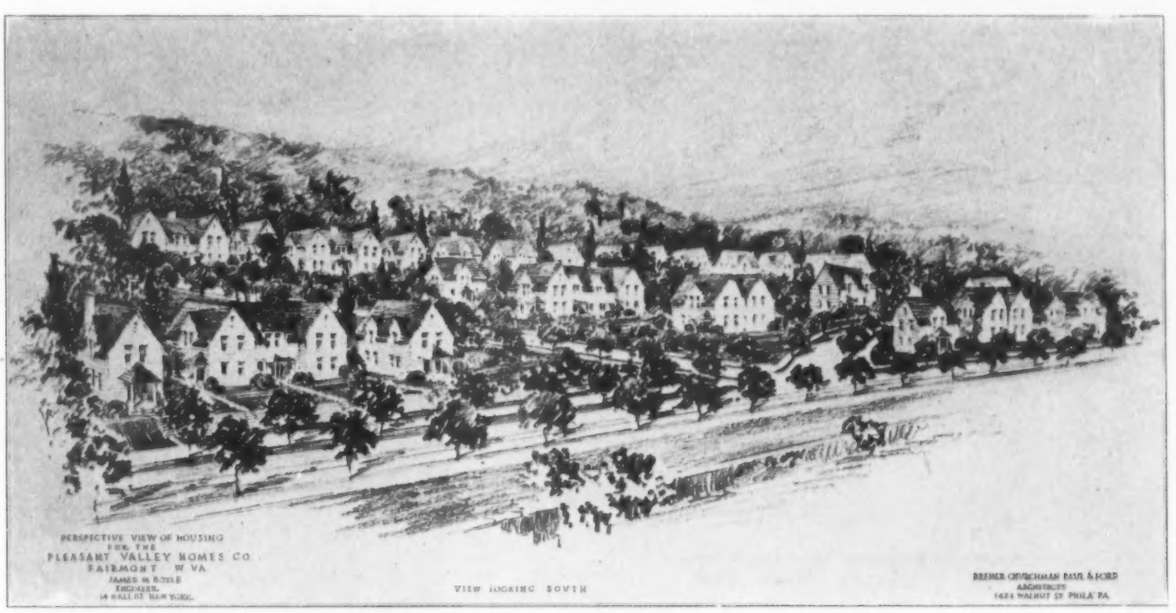
The accompanying engravings illustrate the new rolling mill development of the West Virginia Metal Products Corporation, Fairmont, W. Va. The corporation is organized under the laws of the State of Delaware for the purpose of manufacturing and selling brass and copper plates, sheets, rods, wire and similar products, and has let the contract to the Fred T. Ley Company, of Springfield, Mass., and New York, to build a mill and plant having an eight-hour minimum capacity of 80,000 pounds of finished brass and 20,000 pounds of finished copper.

shares of common stock without nominal or par value.

The prospectus just issued by the corporation states that the brass and copper rolling mill, while being located at Fairmont, is a state institution and the stock has been heavily subscribed to throughout West Virginia. The prime reason for starting a rolling mill in West Virginia is a desire on the part of enterprising business men to develop the natural resources of the State, viz.: coal in abundance, hence cheap electric power (the power plant is built over the coal mine!); natural gas and oil.



THE MILL



THE HOMES

The site consists of 35 acres situated in Fairmont with direct rail connections to the Baltimore & Ohio, New York Central, Pennsylvania and Pittsburgh & Lake Erie railroads.

The authorized capital stock of the company is divided into 25,000 shares of 7 per cent. cumulative, convertible preferred stock, par value one hundred dollars, and 12,500

Fairmont was chosen as the site of the first unit of a large industrial development because of the location there of a 40,000 kilowatt power station, and also because of its nearness to the metal markets of the Middle West. Situated at the gateway to Pittsburgh, the opportunity is offered to transport cheaply the products of the mill. The metal manufac-

turing shops of Pittsburgh, Youngstown, Cincinnati, Toledo, Cleveland, Dayton, St. Louis, Buffalo and Chicago can be easily reached in competition with the East. This market, it is estimated by the corporation, consumes ten million pounds of brass and copper products per month.

Ground has now been broken by the contractor for not only the mill, office and casting shop buildings, but also for some two hundred houses for the employees of the company, and the contract just let calls for the completion of the project by April 1, 1920.

It is intended that the mill project will be followed by establishing in Fairmont manufacturing industries of various kinds, which will not only benefit by cheap power, fuel and light, but will also be able to get their metal at first hand from the mill. Several companies, notably an automobile radiator factory and an automobile supply shop, have already negotiated for sites, so that Fairmont will become the "brass city of the South."

The officers of the company are: J. E. Watson, president; M. L. Hutchinson, vice-president and treasurer; James M. Boyle, vice-president; George M. Alexander, secretary; Louis J. Krom, works manager, and Ferdinand Deming, master mechanic. The New York offices of the corporation are at 14 Wall street.

CO-OPERATION AND INDUSTRIAL PROGRESS*

CYRUS MCCORMICK, JR., WORKS MANAGER, INTERNATIONAL HARVESTER COMPANY, CHICAGO

It is not the purpose of the present paper to analyze completely all of the various causes entering into the industrial unrest that has swept over the world as a result of the war. Many conferences have given their attention to this subject and have adopted findings differing not so much in essential features as in the details of the plans suggested to ameliorate existing conditions.

It has been suggested that the difficulties under which employers and employees are operating are due to the nervous tension resulting from the war; to the high cost of living; to the fear of unemployment; to insufficient wages; to desire to share in the profits of industry; to a revolt against the old order of things whatever that may have been, etc. Each critic has, however, been more or less in agreement that the war taught nations once and for all time that individual workmen must be regarded as human beings. They are, to be sure, an element in production just as is the management, but the time has gone by when human labor can be bought and sold as are machines, tools, or raw materials. This lesson has long ago been learned by the majority of American employers, among whom the more liberal have for years been taking every forward step suggested to bring about a humanizing of industry. The results of the war, however, have made radicals out of many conservatives, until at the present time some of the older European nations have, in theory at least, gone ahead of the United States. The man, as opposed to the machine, has the power to think, and is endowed with a soul. He is at last seeking recognition of this fact.

In agreement with many critics of the present industrial situation, I believe that the most significant feature in labor conditions of the day is the expressed desire of labor to share in the management of business. This desire has taken on various forms in different parts of the world. In Russia we see it as Bolshevism, which is nothing more or less than a practical application of the doctrines put forth some years ago by the I. W. W. in this country. The Bolsheviki tell us that the entire product of Labor belongs to Labor, and therefore they do not wish to have any one receive a share of industry who is not engaged in manual production. Without attempting to argue the economics of this situation I merely call attention to it as the most radical phase of this desire. The Russian wants not only a share in the management, but the entire management. It has also been said that 65 per cent. of the strikes which have taken place in Central Europe since the war are of purely syndicalist origin. In this country we have had demand after demand catalogued generally under the term of "better conditions." In England we have seen a complete disruption of industry from which has grown up the socalled Whitley plan and, more recently, the ever-widening clamor for nationalization of industry. The underlying significance of all these movements is the final realization that the relations of employers and employees must from now on be formed on something besides a cash basis. The workman is as interested as ever in his wages and in his hours, but he is asking for more. Sometimes the demands are not well understood even by those putting them forward. What the workman really wants is self-expression. They are asking the right to discuss and adjust matters affecting their own interests.

Many employers in this country, sensing this situation, are admitting the right of their employees to discuss in joint conference, matters affecting the mutual interests of capital and labor. This, of course, has involved a recognition of the principle of collective bargaining. Economists of the older school tell us that collective bargaining is detrimental to the best interests of the employees and that any artificial interference with wages will result in an artificial attempt to regulate prices. They claim that values are regulated by economic laws. This, of course, is true to a certain extent, but on the other hand it can be argued that collective bargaining is an aid to humanity and that it allows other economic laws to operate which might otherwise be held in abeyance. Not many years ago the doctrine of "caveat emptor" ruled every economic transaction and the business world was permeated with the ethics of David Harum. Just as that doctrine has vanished, so now is vanishing the fear of collective bargaining, and we find ourselves not only admitting the right of workmen to participate in the determination of working conditions but also discussing how this right may be most surely exercised. The method finding most favor in this country can perhaps best be classified by simply calling it employee representation.

REASONS FOR ADOPTION OF EMPLOYEE REPRESENTATION

There appear to be four main reasons why employers are seriously considering the adoption of employee representation.

1. Syndicalism has made such rapid strides in eastern Europe that some men, not recognizing the fundamental solidarity of the American people, are afraid that this country is about to deliver itself to Bolshevism; therefore they are seeking to head off this unrestrained development and to provide a saner method by which the legitimate desires of the workmen for self-expression may be granted without at the same time completely ruining our present industrial fabric. Men of this opinion argue that the laborer has a right to speak for himself, and wish to give him this right before he resorts to revolution to obtain by force what he may think is being withheld from him. They believe discussion in an open forum cannot but bring results and that through efficient co-operation capital and labor, working together, will avert any possible danger of anarchy.

2. There is a close parallel existing between the movement in favor of employee representation and the growth of democratic government. Europe in the eighteenth century considered Frederick the Great's government to be nearly ideal. Later thinkers have called his government a benevolent despotism. Frederick was an enlightened man who elaborated a theory of government whereby the monarch sincerely tried to do the best he could for his people but always with the end in view of solidifying and increasing his own personal power. He built them fine buildings, instituted systems of education, did everything in his power to keep his subjects happy, but all with the object of furthering his own ambitions. Eighteenth century Germany was materially happy but individually it was not allowed to have a voice in the direction of its own affairs.

Frederick was autocratic as any czar and his form of government a despotism; but because he tried to do right and interpret in the fairest sort of way the desires of his people, his despotism was benevolent. Now, until recent years our

*A paper delivered before the convention of the National Safety Council, Cleveland, O., Oct. 1, 1919

industrial system was also a benevolent despotism. Large employers in this country and abroad instituted welfare work; started systems of insurance and compensation; made the conditions of their working people as pleasant and safe as possible; but everything that was done was paternally imposed from the top and did not come as a result of the expressed desire of the great body of employees. This system was benevolent, to be sure, but it was nevertheless despotic to a great extent. Just as benevolent despotism in politics has given way to a great democracy wherein the governed have every right of self-expression, so in industry we are now finding the old system being set aside. Now the employee is not only given the right, but is urged to accept it, to sit on an equal basis with his employer and decide every question which affects his interests. Industry is becoming democratic.

3. It is easy to point a finger of scorn at our present civilization and condemn it as being overly materialistic. Metaphysicians from Aristotle to the present day have argued against materialism. Phrasing their thoughts in the vernacular and adapting their theories to modern times, we may say that we must find some new cause for our existence besides the worship of the almighty dollar. The joy of doing things rightly will in the end give men a more real satisfaction than the material results of their efforts. Applying metaphysics to employee representation, we may describe it as a concrete effort to introduce moral right into industry. It will be many generations before materialism vanishes from our daily life but surely employee representation is a step in the right direction. Idealism, after all, is something the world would do well to analyze as a necessity of today rather than of the hereafter.

4. Looked at superficially, employee representation is expensive. It costs a certain amount of money to pay the added salaries, to do the clerical work involved, and the like; but those employers who have had the best experience say that it is really economical and efficient. They believe it pays; they believe the added interest a man must have in his work when he knows he has a share in the control of it, will go a great way toward bringing about the final efficeincy of production which must be secured if the present pace of manufacturing is to be maintained. Scientific management has just one more step to take. It must become endowed with soul in order to become more efficient; and its savings must depend not upon force or will but upon the consent of the governed. The war has proven that democratic society, while superficially less efficient than autocracy, is in the end far stronger in the face of the most awful competition human ingenuity can devise.

FUNDAMENTAL PRINCIPLES UNDERLYING EMPLOYEE REPRESENTATION

There are certain fundamental principles underlying any plan of employee representation. These are as follows:

1. In the first place, there must be full representation (here I quote from the plan of the International Harvester Company) "on all questions relating to working conditions, protection of health, safety, wages, hours of labor, recreation, education, and other similar matters of mutual interest to the employees and the management." When we came to draft that clause in our plan we decided to make it as broad as possible. We felt the necessity of allowing the plan to include discussion on every possible subject of mutual interest. Those who may be considering undertaking such a plan must make up their minds to go into it completely or not at all. The plan must be broad if it is to be democratic, and if it is not broadly democratic it cannot succeed. The time may come when employees will wish to share in the executive management of a business. This, however, will be a matter for generations of education and development; and at the present time no one except the syndicalists is demanding participation in the management except as it affects the interests of the men.

2. A truly democratic plan of employee representation must involve joint conference between men and management. Without entering into a discussion of who may constitute the parties in industry, I may take it for granted that they include, capital, labor and the consumer. As long as these three interests remain unacquainted with each other they must be mutually suspicious. Under employee representation we cease to fear discussion. We believe that if any subject can be brought out into the open where it can be tested by the clash of men's minds and where honest opinions are exchanged in free and happy discussion, a right solution cannot be long delayed. The fundamental point is to get together; to talk things over; to debate them; to understand each other's intelligently expressed opinions—and then the solution will come by itself.

3. The third point is to have sufficient representation. The numerical unit of representation will largely be dependent upon the character of the business in question. Small factories or offices may have one representative to each 25 or 30 employees. Large factories may have one representative to every 200 or 300 men. Suffice it to say that the constituency must be small enough to give each voter some contact with his representative. On the other hand, it must not be so large that the council, committee, or legislative body is so numerous that there can be no real discussion between the representatives of the men and the management.

4. There must be an easy, secret method of election to give the men absolute freedom in choosing their representatives. The War Labor Board considered this question at great length. They at first thought it advisable to hold the elections outside the plant for fear of there being some interference on the part of the management. Subsequently, however, they reversed this practice. In no case, however, to my knowledge, where such a plan is in operation, has any employer tried to direct the voting. It has been found advantageous to all concerned to allow workmen just as much freedom in choosing their industrial representatives as they already possess in choosing their congressmen or aldermen. Only if the choice is absolutely free will the appointed representatives of the management be able to get in touch with the real opinion of the men.

5. The plan must provide for an easy method of appeal to the highest authority in the company. Red tape must be conspicuous by its absence. If a workman has some grievance which he cannot settle directly with his foreman he may call his representative into conference. If these three reach an agreement the matter is then settled. If not, the employee representative may take the matter straight to the superintendent of the plant. If the matter is then not settled it should go easily and quickly to the works council, where representatives of the management and the employees will deliberate upon its merits. If they are unable to settle the affair it should go to the president of the company. If the president cannot accept or suggest a satisfactory adjustment, there comes the question of arbitration. Perhaps here, future developments will assign the duty of arbitrator to representatives of the community, but at present such agencies do not exist. In general if there has been a sincere endeavor on the part of all concerned to examine the question fairly and frankly, there will be small need of arbitration.

6. Any plan of employee representation will fail unless there is a real determination to avoid any discrimination (and here again I quote from the International Harvester Company plan) "on account of race, sex, political or religious affiliation, or membership in any labor or other organization." This does not mean, for example, that an employer forfeits the right to employ whomever he wishes; it does mean that once a man has been considered worthy of employment he has now entered into the bosom of the industrial family and must be considered worthy also to express his own opinions upon matters affecting himself.

7. If employee representation is to succeed it must have executive supervision, just as industrial concerns employ specialists in machining, in foundry work, in heat treating, in progressive assembly, in accounting and the like. And as they recently found it desirable to employ specialists in employment and safety work, so now they are finding it necessary to employ specialists in industrial relations. The best man in the country is not too good to act as chief of the department of industrial relations of any company incorporating such a plan. The man chosen may be related either to the president of the company or to the official in charge of production. The labor problem is the great question of today and tomorrow, and the specialist who gives his atten-

tion to its solution cannot be too well thought of in any industrial organization.

THE WORKINGS OF THE PLAN

The workings of the plan have called upon the representatives of the men and the management alike to put forward their keenest intelligence. In the beginning it was quite natural that the first demands were all for large increases in wages. The plan passed successfully a very severe test when it had to be explained to the men, through their representatives, that the financial condition of the company and of the business were not such as to justify a flat increase of wages. Later, when the cost of living rose again, as it did last summer, the question was again brought up, and this time the management representatives accepted the point of view of the employee representatives just as sincerely and fairly as in the beginning the latter had accepted the view of the former. The International Harvester Company, since the inception of its plan of employee representation, has never held back any information from the men. Business policies have been discussed and figures shown which it was our former custom to keep secret. We share their pride in the fact that thousands of men, when given this information, have been able to judge it intelligently and act accordingly.

The company has also been able to discover many inequalities in the wage scale which it did not dream existed. For example, it was brought to our attention that we had a number of men who were working seven days a week, twelve hours a day. When, through the works council, some of these men objected and asked to be relieved of such an undesirable situation, the matter was immediately cleared up. Piece-work rates have been revised and made equitable wherever it was shown that they were too high or too low in competition with other workmen engaged in similar operations. Numberless small instances have been discovered where men were afraid, under the old system, to complain of situations which they knew were wrong, and now that a natural channel for legitimate complaint has been created, they have found it to their advantage, and, therefore, to ours as well, to see to it that wrong things were set right.

Shop discipline cannot be upset if the plan is operated correctly, and if management and men alike understand its sincerity and underlying principles. If an employee representative of foreman takes the attitude that it is their duty to act as a check upon each other's activities there will be fricion. If the superintendent does not realize what he can gain from the co-operation of his men he can instill in his executive force a fear of industrial democracy no less keen than that with which English county officials regarded the Reform Bill of 1832. When the great majority of employers a few years ago accepted the principles of scientific employment and took away from their foremen the right to hire and discharge, the claim was made that the foreman's authority would be undermined and his discipline ruined. That did not then prove to be the case, and no more now is a foreman's authority undermined by employee representation. By discipline, I, of course, mean intelligent obedience, rather than skill in executing the goose-step.

So far as trades unionism is concerned, our friends of the American Federation of Labor have mistaken the trend of employee representation. In the very important convention held at Atlantic City in June of this year, there were adopted elaborate resolutions condemning employee representation, on the ground that elections were unfair; that democratic organization was not permitted; that the committeemen were intimidated, and that an employee in pleading his case could not have the aid of an expert walking delegate to help him marshal his facts. No one who, as I have done, has sat through meeting after meeting of a works council, could believe that any of these charges is justifiable. The basic object of organized labor is to improve the condition of workmen through the principle of collective bargaining. Without doubt this was necessary in the past, and is possibly still necessary in many cases, but now with employee representation, working sincerely and successfully, organized labor should welcome it as an ally which is seeking the same fine result and achieving it with more immediate and intimate satisfaction than is possible for an organization not controlled by the men of any given factory themselves. Employee representation has not been set up in opposition to organized labor. It is not an endeavor to create company unions or to do anything to deprive the men of the results which long years of industrial history have secured for them. It is a sincere effort to bring capital and labor together for the benefit of each, and to develop between them a family feeling of mutual interest which cannot but be helpful to the development of industry today and tomorrow.

A TEST OF EMPLOYEE REPRESENTATION

In the recent labor difficulties in Chicago, employee representation was forced to stand an acid test. We have eight plants in Chicago, in seven of which there are works councils. Due to various causes, such as strikes in large neighboring establishments and the presence of a large number of non-American groups of employees, a strike was begun in that plant where there was no works council. When these men, without making any demands, were out upon the street, they proceeded in a body to adjacent factories where there were works councils. The day before this took place the councils in these other plants had negotiated a settlement between the men and the company, which satisfactorily adjusted all questions at issue. In spite of this adjustment the intimidation of the large number of foreign employees from the striking plant, and the slugging which immediately took place, caused the works councils in four of the remaining plants to advise the cessation of operations. The company accepted the request, and for three weeks these four plants were closed down. The period would not have been so long had there not intervened the terrible race riots and a severe street car strike.

When conditions were right and the works councils felt it desirable and safe to resume operations, the plants were reopened. It is at least significant that the resumption of work took place with hardly a ripple of excitement, and with no violence of any kind. In two other plants the adjustment was never questioned from the beginning. We, therefore, found as a result of this labor difficulty that our works councils were stronger in the minds of the men than ever before. They stopped work in the plants when it was dangerous to continue to operate. They opened the plants when it was safe do do so (even taking it upon themselves to arrange for the preliminary police protection) and in every way proved themselves worthy representatives of the best traditions of American industry.

ENGLISH AND AMERICAN SYSTEMS

Employee representation has spread more rapidly in England than it has in this country, but it has taken a different form. Much has been written about the so-called Whitley Plan. That may be desirable for England, but it will not do for this country. Here neither industry nor labor is sufficiently organized to set up the elaborate system of councils required under the Whitley Plan. Nor is our government sufficiently versed in the handling of industrial matters to take as important a part in industrial councils as is required under the English system. Finally, the Whitley Plan has organized British industry into two opposing camps, whereas the American system of employee representation is based solely upon mutual co-operation and a substitution of vertical for horizontal divisions. Class prejudice has no place in this country, either in society or in industry.

After all is said and done, the fundamental point in our industrial trend today is the representative direction of industry; all else is really detail. Profit sharing may come when it is ripe for it to do so. Governmental action or rearrangement of our program of consumption may make it possible for employees to be free of fear of unemployment. Education may raise the standard of working conditions to a real art. But if workmen are allowed self-government they and their employers together can work out these programs. If not, they will never enjoy them. If the step of accepting employee representation is now taken by the American industry as a whole, the future is secure. The working out of all details can be safely left to the joint deliberations of that active intelligence, which, common to both men and management, has placed American industry where it is.

THE "STOP WATCH" IN INDUSTRY

C. E. KNOEPPEL

From 75% to 85% of the possible results from modern methods of management in industry can be secured without the use of the "Stop Watch" in timing workers and studying operations.

This may seem a rather startling statement, but it is based on a sincere conviction at a time when the announcement may serve to advantage in focussing the eyes of both workers and employers, on the absolute necessity of greater production in industry, that we may reduce the cost of living and improve the relations between Capital, Management and Labor.

In the past, I have advocated the use of the "Stop Watch." I have used it in my professional work. I have instructed others in its use, and have had others use it for me. Some four years ago, however, I began to see evidences of its unpopularity in industry, and began to study the entire situation with the view to getting along without it, since which time our organization has made no use of the "Stop Watch" in its regular work of eliminating industrial inefficiency We see no use for it in the future, in so far as the writer and his associates are concerned for excellent results have been and can be secured without its use.

Our experience has convinced us that the inefficiency almost universally met with in industry, which is the one factor responsible for the high prices we are now fighting, is not all due to the inefficiency of the worker by any means. As a matter of fact **the greatest part of the inefficiency found is due to the shortcomings of management.** Unless a plant is properly organized; unless there are reliable records on which to base conclusions; unless production is properly controlled; unless working conditions and facilities are what they should be, workmen cannot work efficiently, whether they want to or not.

Idleness in equipment; waste in floor space; inadequate manufacturing facilities; too much material tied up in stock; over-equipment; breakdowns and repairing equipment during working hours; failure to provide work, or material, or tools on time, are certainly factors not within the control of the workers in a plant.

This does not mean that there is no inefficiency on the part of the workers, but it does mean that the greatest inefficiency is that of management and that you cannot get a high degree of labor efficiency with a low management efficiency.

Our experience proves further that through efficient organization, proper records, control of production and improved facilities, manufacturing efficiency can be materially increased, and in accomplishing these things we have found that no "Stop Watch" is at all necessary.

This brings us up to the matter of the worker's part in industry. In the use of the seven essentials necessary in industry

1—Supplying the funds	Capital
2—Providing the plant	"
3—Furnishing equipment	"
4—Providing an organization	"
5—Placing orders for work	"
6—Supplying material	"
7—Doing the work	Management
	"
	Labor

labor is only concerned with one of them—doing the work. In this the element of time enters, and the thought behind the use of the "Stop Watch" has been to study this use of time by labor.

It is, of course, true that labor has felt that the less hours it worked the *more* work there will be for *more* people. In some cases labor has even gone so far as to take the attitude that it should reduce the amount produced per hour, so that in our experience we have been observing a threefold tendency:

(a) Less hours' work per man

(b) Less production per hour per man

(c) Greater wages per hour per man

which is the basis of the vicious cycle of increasing prices.

The "Stop Watch" will never get these ideas out of labor's mind, even if it does show that these conditions exist. Only education and bitter experience will show labor the fallacy of **less hours for more wages,** which narrows the use of the "Stop Watch" down to:

(a) Determining equivalencies and tasks

(b) Determining lost motion and waste

as they relate to the use of time by labor.

We realize only too well the economic importance of increasing hourly productions by labor, and that equivalencies must be known in advance so that they may be currently watched and comparisons made. Determining what is a fair hour's work for different operations in industry, that men and equipment can turn out without injury to health or well-being, or detriment to equipment, is what is meant by equivalency. This to our mind is an economic fundamental, for if we can secure increased hourly productions we need not concern ourselves so much about the matter of wages or the hours of labor. It is altogether a matter of securing production by utilizing every facility that can be invented and every method that can be devised toward getting out a maximum or quantity production. The greater the hourly production the less the cost. The less the cost the greater the demand, and the greater the demand the more business there will be. The more business there is the more demand there will be for labor.

We have found, however, that careful estimates with changes in hourly production rates made from time to time, up or down, will ultimately bring hourly equivalents to where they would be if a "Stop Watch" had been used. The logical question arises—"How will these estimates be made if we do not use a 'Stop Watch'?" **By conferences between those responsible for determining these hourly equivalents, the workers and the foremen, studying the work to be done, plus an analysis of records showing past performance.** In other words, determination of hourly equivalents would be a matter of bargaining, based on intelligent discussion, which would get away from the arbitrary methods so often pursued in setting rates. If subsequent effort proved the hourly equivalent to be beyond the attainment of the worker it is corrected in the same manner as it was set. If the equivalent is easy of attainment, the same method is followed in increasing it. In other words, it is a "Give and Take" proposition. Further, in determining hourly equivalents, the idea is to arrange for an average performance by an average man over an average period of time.

The use to which we put these hourly equivalents is in planning and routing work through the plant so that in dispatching shop operations, like in dispatching trains, we may know the length of time between points and arrange accordingly. They are not used for setting piece rates or bonus times as in our philosophy the matter of incentives should not be taken up until proper organization, records, production, control, proper plant conditions and facilities and knowledge of hourly equivalents are provided. We have found that if they are provided, any fair method of wage payment will induce the support and co-operation of the worker and enable him to work to better advantage.

It is apparent therefore that the "Stop Watch" is not needed in determining hourly productions, as intelligent estimates based on proper discussion and a study of the work, will serve in the long run to make equivalents as accurate as if determined by "Stop Watch" study. In determining lost motion and waste the steps above outlined will do much to locate and eliminate them. To adequately control production it is necessary to perfect organization, provide records and study and better equipment and facilities, which in themselves will do much to increase operating efficiency. Therefore, if the "Stop Watch" is not a factor in the one case it is certainly not a factor as regards the other.

We have no quarrel with those who advocate the use of the "Stop Watch." Refinements in results can undoubtedly be secured through its use. The "Stop Watch" can in many cases be used in determining what equipment should do, although in this it has been our experience that mathematical calculations will determine what equipment should do on a given piece of work. We have simply found through our own experience and this is our best teacher, that we have been able to operate to advantage and secure satisfactory results in industry without the use of the "Stop Watch."

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR, Plating-Chemical

BEARINGS

Q.—Please advise what is considered best standard bronze composition for hot rolling mill bearings.

We understand the temperature of these bearings approximate 600 deg. Fahr.

A.—As the temperatures and pressures of hot rolling mill bearings vary within considerable limits, it is scarcely possible to consider any one composition as standard.

A composition that cannot be excelled for anti-frictional qualities and which is well fitted for moderate pressures and temperatures is the so-called plastic bronze. This alloy consists of:

Copper	64.0
Lead	29.5
Tin	4.5
Zinc	1.0
Nickel	1.0

One large steel company that makes its own bearings uses the following mixture:

Copper	78
Tin	10
Lead	10
Zinc	2

One defect of the alloys containing lead and tin in considerable amounts is the fact that these metals form an eutectic or low melting point solder, and as soon as the temperature of the bearings reaches about 400 deg. Fahr., this eutectic will form globules that are wiped off the bearing by the revolution of the rolls, causing excessive wear. While nickel tends to prevent the separation of this eutectic, it is but a partial remedy. Recently an aluminum bronze of great hardness and strength has been used by certain mills for hot rolls and it is said to have a remarkable life under very severe service conditions. This alloy consists of:

Copper	90.0
Aluminum	7.5
Iron	2.5

The iron may be added as tin plate scrap.—J. L. J. Problem 2,758.

BUFFING

Q.—We make a large quantity of low priced drop forged nickel plated slip joint pliers, like samples mailed you under separate cover.

These pliers are forged from a fifty carbon steel and hardened. They are then burnished in a Baird burnishing barrel using steel balls, to a high finish. They are then nickel plated and our present method is to buff by hand but, we believe, that some method could be used of buffing them in a burnishing barrel if properly worked out.

We understand that some material of similar nature is burnished by the use of hard wood blocks in a burnishing barrel, but do not know just what process is used or what solution is used with it.

A.—1. In our opinion if you desire to eliminate hand buffing the most efficient method for you to use would be the dry tumbling method. This method consists in tumbling the nickel plated articles in scrap sole leather, as a polishing medium. Small proportions of powdered Barium Carbonate or Acme White Finishing reduced to a powder should be included with the scrap leather. This method will give an excellent polished finish to the Nickel deposit.

2. We have never heard of the use of Hard Wood blocks in tumbling to produce a polished finish either wet or dry. However by the dry method it is possible that they could be used with a polishing medium as outlined above, but the leather would prove more effective. Small blocks of Lignum Vitae are frequently used in connection with Nickel Plating to separate the articles during the plating operations which aids in the burnishing of the articles during plating by friction. Hard wood blocks could not be used because they would float continually to the surface of the solution.

3. In the wet method of tumbling after Nickel plating a solution prepared from water containing one to two ounces of Cream of Tartar or Acid Sodium Phosphate could be used per gallon of water together with a small amount of Soap Bark as a lubricant. Steel balls or blocks of Lignum Vitae might be tried as agents in producing a polished lustre.—C. H. P. Problem 2,745.

CASTING

Q.—We are trying to cast small articles in nickel alloys with wire cores, and find the casting blown in holes. Can you give us information as to a safe parting or wash for the wire cores?

A.—If the blow holes are due to the core wires, the latter are probably rusty. They should be perfectly dry and free from rust. They may be coated with a "wash" made by adding a saturated solution of borax in water to finely-powdered fireclay. The consistency of the wash should be that of thick gruel, and it should be applied to the wires by dipping or painting on; the wires should then be slowly dried and baked at a temperature well above the boiling point of water. A wash could be made of facing sand, or fireclay and linseed oil, but the oil might lead to the formation of gases and production of blow-holes.—W. T. F.

Q.—I am mailing you, under special cover, sample of a broken casting. Will you kindly advise me what, in your estimation, is the trouble with the metal? The mixture is almost 88 cu., 10sn., 2 zn. My idea is that the metal is burnt in the furnace.

A.—Our examination of the broken casting in question discloses considerable oxide and dross in the fracture. The structure is coarse and there is a "copper spot" or segregated area in the center of the casting. It is evident that the metal has remained too long in the furnace. It has been both overheated and poured at too high a temperature.

In making the 88—10—2 alloy a good grade of copper should be used. It should be melted quickly and hot. The zinc should then he added and the metal allowed to stand a few minutes until it has been thoroughly deoxidized. The tin should then be added, a little at a time, with vigorous stirring. It has been found that pouring into ingots and remelting gives a denser, closer-grained metal and stronger, tougher castings. Where a considerable proportion of gates and risers or other remelted material is used the result is equivalent to pouring into ingots and remelting. This scrap, however, should not be too light and its identity should be beyond question.

The metal should be well covered with charcoal and not held in the furnace after it is ready. The moulds should be ready when the metal is ready. If they are not ready, it is better to pour the metal into ingots than to allow it to "soak" in the furnace, for defective castings will be had if this happens.

Most important of all is the pouring temperature. This should be about 1,200 deg. C. A nickel-chromium pyrometer sheath is now obtainable which withstands molten brass very well and protects the pyrometer leads. The pyrometer may be kept at about 1,000 deg. C. by the aid of a small wire-wound electric heater, so that when it is immersed in the molten brass the temperature is obtained promptly, and the time of immersion thus much shortened. No pot should be poured without its temperature being known.—J. L. J. Problem 2,753.

PLATING

Q.—Can you furnish us with a formula for a 14-kt. gold solution? At present we are making our 14-kt. gold solution by the porous cup process, but we are unable to obtain uniform results. When the solution is first made we obtain a very uniform color, almost like a fine gold. After the solution has been running for a few days the color is too red and we have to add silver, but this is not very satisfactory. Is it possible to make the solution so that we could obtain a uniform color?

A.—Whenever gold and copper are present in a cyanide solution the copper has a greater affinity for the cyanide, so the gold is deposited in excess until the solution becomes depleted, after which the copper is deposited almost exclusively. By using the following formula a uniform deposit will be obtained provided the solution is used hot with a high voltage (6-10 volts):

14-kt gold	4 dwt.
Cyanide of sodium	2 ozs.
Bisulphite of soda	1 oz.
Phosphate of soda	2 ozs.
Carbonate of soda	1 oz.

Whenever a 14-kt. solution yields a color that is too red, a little carbonate of nickel or carbonate of cobalt may be added, with better results than can be obtained by using silver.—O. A. H.

TINNING

Q.—We are doing a great deal of electro-tinning on adapters, star shell sections, etc., our solution being composed of powdered caustic soda, tin salts, pot bi-tartrate, and gelatine. We find this solution very expensive to keep up as the test is a stringent one and the solution requires constant renewing. Could you suggest a cheaper method, and could scouring the articles be avoided by any means?

A.—There is absolutely no necessity to use bi-tartrate of potash (which is very expensive) in conjunction with the other ingredients. You do not state whether the solution is worked hot or cold. If worked properly, frequent renewals should be unnecessary. Scouring depends on the article. Boiling in cleaning solution should be adequate, and no scratch brushing is necessary.—G. J.

Q.—We are requiring to tin some iron castings which are treated after rumbling without any machining, and shall be pleased if you will advise us as to the strength of a pickling solution and tinning fluid before we apply our solder, which is half tin and half lead. Should we get any better results by using 60 per cent. tin solder?

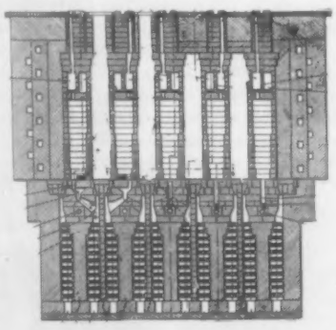
A.—If the castings in question are very common iron it will not be found practicable to tin them; if they have been annealed, the matter becomes possible. Shaking or rumbling is also a question of importance and should be thoroughly well done. If this is accomplished properly, it removes sand, graphitic carbon, and silicon scale, and gets down to the iron. Then a 10 per cent. hydrochloric acid solution will answer as a pickle, and the articles before tinning should be dipped in powdered sal-ammoniac. Pure tin will give better results than the Terne (lead and tin alloy) mixture. The whole thing, however, is difficult, and depends entirely upon the degree of perfection with which the rumbling or shaking is carried out.—G. J.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

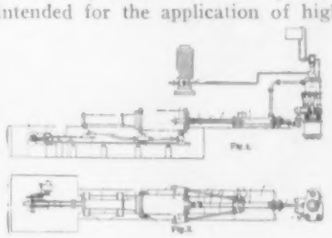
1,312,372. Aug. 5, 1919. **Coking Retort Oven.** Joseph van Ackeren, of Pittsburgh, Penn., Assignor to the Koppers Company, of Pittsburgh, Penn., a corporation of Pennsylvania.

This invention relates to coking retort ovens, and more particularly to those of the well-known Koppers combination gas-oven and coke-oven type, exemplified in the Koppers coke-oven Patents 1,026,169, 1,176,067 and others, and also more particularly relates to coking retort ovens that are of the well-known Koppers cross-regenerator type, exemplified in the Koppers coke-oven Patent 818,033 and others, and that have the flue-construction set forth or claimed in the Schwab coke-oven Patent 989,302, and also more particularly relates to such other coking retort oven constructions as are hereinafter set forth or claimed. And the invention includes among its objects an increasing of the coking efficiency of such ovens, an increasing of their flexibility of operation, a reducing of their cost of maintenance, an increasing of their permanence and durability and resistance to the strains and variations of the high temperature conditions to which they are subjected, and such other improvements or advantages in construction and operation as are found to obtain in the structures and devices hereinafter described or claimed.



1,312,367. August 5, 1919. **Press Applicable for the Production of Briquets and for Other Purposes.** Edgar Rouse Sutcliffe, of Leigh, England, Assignor to Pure Coal Briquettes, Limited, of Cardiff, Wales.

This invention relates to the operation of presses and has for its object to effect the operation at high speed of presses intended for the application of high pressures.

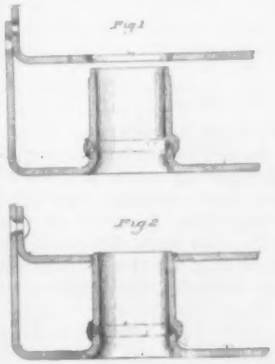


The invention is of general application to presses for the production of briquets and for other purposes as for example for metal pressing or forging where very high final pressures are required.

1,312,152. August 5, 1919. **Hollow Sheet-Metal Structure and the Manufacture Thereof.** Thomas Barrow, of Wheatland, Pennsylvania, Assignor to Blaw-Knox Company, of Hoboken, Pennsylvania, a Corporation of New Jersey.

Figure 1 is a sectional view showing in partly assembled condition a structure embodying this invention; and

Fig. 2 is a similar view showing the completed structure.



This invention has relation to sheet metal structures of that class which are provided with tuyeres or other laterally inclosed openings which extend therethrough. The invention is designed to provide a structure of this character having a tuyere or other hollow member extending therethrough which is practically integral with the portion of the structure through which it extends. Also to provide a method of making the same which can be readily carried out at a relatively small expense and in a simple and convenient manner.

EQUIPMENT

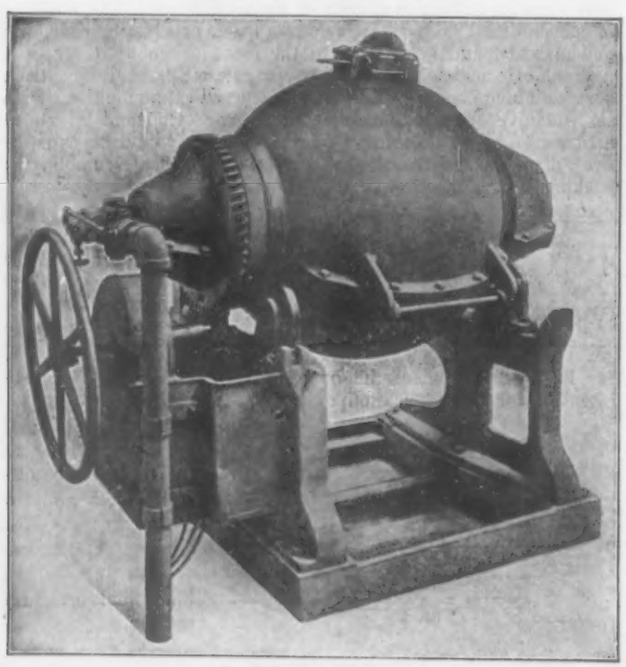
NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

THE MONARCH CONTINUOUS REVOLVING NON-CRUCIBLE METAL MELTING FURNACE

This furnace is a direct development of the Simplex type. The feature in which it differs from the Simplex is its motor driven, continuous rotary motion, which gives greater length of life to the linings, decreases the melting period, and saves labor.

OPERATION.

The burner is placed at one end, and the charging and skimming takes place at the other. The venting of the gases takes place at charging and skimming end. The rotation of the furnace starts as soon as the metal begins to soften, which should take place about fifteen or twenty minutes after the flame has been started. When the metal is ready for pouring, the current is cut out at a point when the pouring spout has nearly reached the



CONTINUOUS REVOLVING MELTING FURNACE

pouring point; the pouring is then effected by the aid of the hand wheel.

FUELS.

Gas or oil may be used with equal advantage. The cost per thousand cubic feet of gas or per gallon of oil is the determining factor. Any efficient system of burning gas or oil may be applied.

METALS TO BE MELTED.

Any of the metals in general use in the foundry may be successfully and economically melted. In addition to its adaptability for the melting of metals for general casting work, it is useful as a scavenger for foundry refuse, such as slags, grindings, washings, etc., the mechanical puddling effect being of the first importance with this class of material. Soft metal drosses, skimmings and sweepings can be recovered with speed and economy.

For prospective installation the following information is needed:

Amount of metal per heat required.
Amount of metal per day required.
Approximate mixture of metal.
If oil system has been installed, what pressure?
If gas state whether city or natural.
If air system has been installed, what pressure?
And what would be the cubic feet per minute available.
Electric current for motor, state if D. C. or A. C. Giving voltage-phase and cycle.

SPECIAL NOTICE.

When contemplating the installation of a melting system, it is important that provisions be made for an adequate supply of fuel and air. The following tables give the approximate quantities required per each 100 lbs. of metal melted:

City gas of 600 B. T. U. about 400 cu. ft. per each 100 lb. metal melted.
Natural gas of 1,000 B. T. U. about 200 cu. ft. per each 100 lb. metal melted.
Fuel oil of 144,000 B. T. U. about 1½ gallons per each 100 lb. metal melted.
City gas will require 600 cu. ft. of free air per each 100 cu. ft. of gas.
Natural gas will require 1,000 cu. ft. of free air per each 100 cu. ft. of gas.
Fuel oil will require 1,500 cu. ft. of free air per each gallon of oil.

Approximately 750 lbs. of metal may be run down per hour, and from this may be figured the quantity of fuel or air required per minute or hour.

When contemplating the use of gas as fuel the local gas engineers should be consulted so that the proper size and meter may be provided.

SIZES.

5	.....	Capacity	.....	500 lbs.	per	heat
10	.....	"	1,000	"	"	"
15	.....	"	1,500	"	"	"
20	.....	"	2,000	"	"	"

NICHROME CASTINGS FOR HEAT TREATMENT

In heat treating processes such as annealing, carbonizing, hardening and tempering, there is a demand for containers or receptacles, made of metals or alloys which will maintain their strength and durability at high temperature. Such receptacles undergo repeated cooling and heating from 1500° F. to 1850° F. and in order to avoid costly maintenance due to additional expense for labor, fuel, material and constant replacement, the heat treating containers must not be subject to cracking, changing in form, forming a surface scale or warping. Where the walls of annealing boxes, carbonizing boxes, etc., increase in thickness due to growing, or form a hard surface scale, relatively more time is required for the completion of the heat treating process. In this case it takes longer for the heat to penetrate in to the work. Where the physical strength of the material is comparatively small, it is necessary to increase the dimensions and weight of the receptacle to such an extent as to make handling difficult and to require considerable labor. The walls of heat treating containers are preferably to be made as thin as possible in order to facilitate the greatest heat penetration.

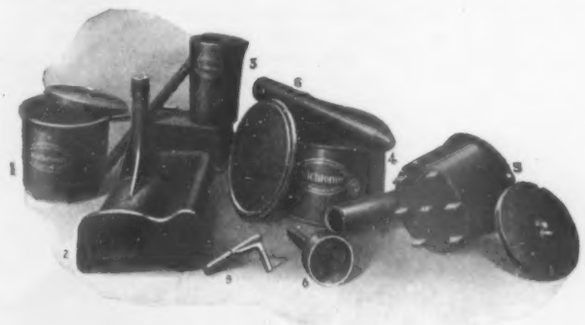
STRENGTH OF MATERIALS AT LOW AND HIGH TEMPERATURES.

Although many metals and alloys have almost any required physical properties at ordinary temperatures, still all undergo a reduction in strength, change of form or scaling of the exposed surface at high temperatures.

There is a destructive reduction in the physical strength of cast iron, cast steel, structural steel, and wrought iron, and other ferrous materials when subjected to relatively high temperatures. Although in one set of experiments, structural steel at 400° F. showed an increase of 32 per cent of its normal strength at 70° F. and similarly wrought iron at 570° F. had a 16 per cent greater strength than its normal strength at 70° F., nevertheless both of these materials had a tensile strength at

1500° F. less than 18 per cent of their normal strength at 70° F. At 1100° F. cast iron had lost 42 per cent of its normal strength at 70° F. and copper and bronze showed reduction in strength at as low a temperature as 200° F. The figures given would be, in general, subject to variation because of differences in the composition of materials of this class. Nevertheless, they are examples of the destructive effects mentioned above.

When cast iron is repeatedly heated to 1700° F. it undergoes



TYPICAL NICHROME CASTINGS

a change in size which is generally known as "growth," always accompanied by an increase in weight, equivalent to approximately 7 or 8 per cent, which is due to the absorption of gases in the formation of oxide.

At high temperatures the oxidation of the heated metal causes a scale to be formed on the surface of cast steel and wrought iron containers, which usually reduces the size of the pot upon repeated heating, as in the case of annealing and case-hardening processes where the original scale cracks off, thereby exposing a fresh surface, which again scales.

PROPERTIES OF NICHROME.

The injurious effects referred to may be avoided in many cases by the use of a nickel chromium alloy known as "Nichrome." This alloy made by the Driver-Harris Company, Harrison, N. J., is composed of about 60 per cent nickel, and the remainder principally chromium. It is melted in an electric furnace, and is cast in various shapes and in any weight up to 5,000 lbs. Nichrome is already well known since it has been used for some time in the manufacture of resistance coils and elements, for electrical heating apparatus and rheostats. The surface of Nichrome boxes and containers does not oxidize at high temperatures, except in oxidizing atmospheres when a thin film of the oxide is formed which is extremely strong and durable. This

ANNEALING AND CARBONIZING BOXES

oxide film resists the action of alkalis and of such acids as sulphuric and hydrochloric. It is non-flaking and affords additional protection against corrosion or further oxidation.

Unlike iron or steel, Nichrome shows no growth or appreciable change of form, as a result of alternate heating and cooling.

It will bend considerably before breaking, even when red or white hot. This quality may be demonstrated by heating to a red heat a plate of Nichrome ¾ inch thick, and then striking it with a 20 lb. sledge upon the unsupported center of the plate. The result is a very gradual bending.

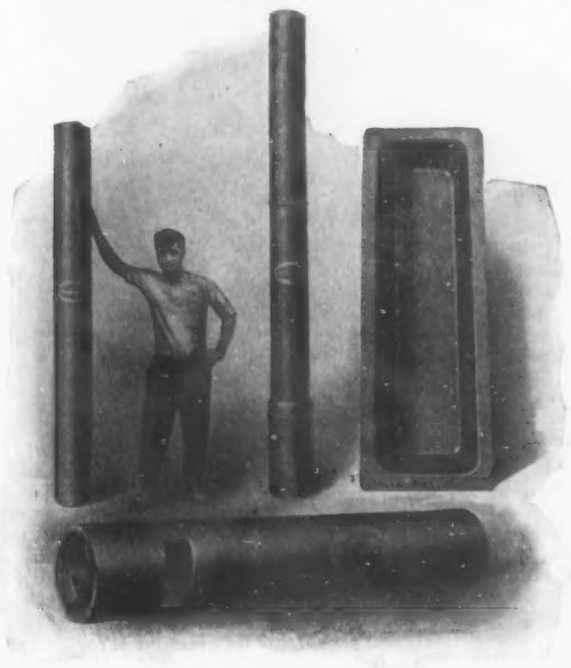
The tensile strength of cast Nichrome at 1500° F. is approximately 24,500 lb. per sq. in., or about 30 per cent greater than the tensile strength of cast iron at 70° F. When cold, Nichrome has a tensile strength of about 50,000 to 55,000 lb. per sq. in. It softens at about 2500° F., and melts at approximately 2750° F.

APPLICATIONS OF CAST NICHROME.

For heat treatment, cast Nichrome is adapted for annealing and carbonizing boxes, heating retorts of various kinds, cyanide hardening pots, lead tempering pots, etc.

Some of the most useful applications of this alloy will be mentioned to illustrate the possibilities of cast Nichrome as a substitute for other materials, in order to avoid cracking, growing, scaling, warping, change of form, corrosion or reduction of strength.

Nichrome castings are used extensively for annealing, and carbonizing boxes. (See fig. 1 and 2.) They are much more durable than boxes made of cast steel. Whereas a steel box must be made quite thick in order to withstand reduction of thickness caused by scaling or oxidation, Nichrome containers can be made thin and correspondingly light. Thus, efficient heat



NICHROME TUBES

conduction is insured at the same time maintaining sufficient strength. The durability of ferrous boxes is limited to approximately two hundred and fifty hours' service at 1700° F., whereas cast Nichrome boxes under the same conditions, quite commonly give seventy-five hundred years' service, and in some cases as many as eleven thousand hours' service has been obtained. While Nichrome castings are more expensive than cast steel or cast iron containers, the difference in cost is more than offset by the superior qualities mentioned, and by the low operating cost per hour which its use assures.

An important industrial application of Cast Nichrome is the dipping basket and holder used in immersing small heated iron or steel parts in a carbonizing cyanide bath at 1700° F. Similar baskets or utensils are used for pickling purposes and heat treating work. These Nichrome baskets may be used for a considerable period of time without being appreciably affected by the cyanide, nor do they shrink or lose weight. They are about one hundred times as durable as iron or steel wire baskets.

Rotary retorts (see fig. 3) of Cast Nichrome for gas furnace applications are used in a great number of plants throughout the country with a life at temperatures of 1600° F. to 1800° F. of from eighteen months to two years, as against twenty days to four weeks with ferrous materials.

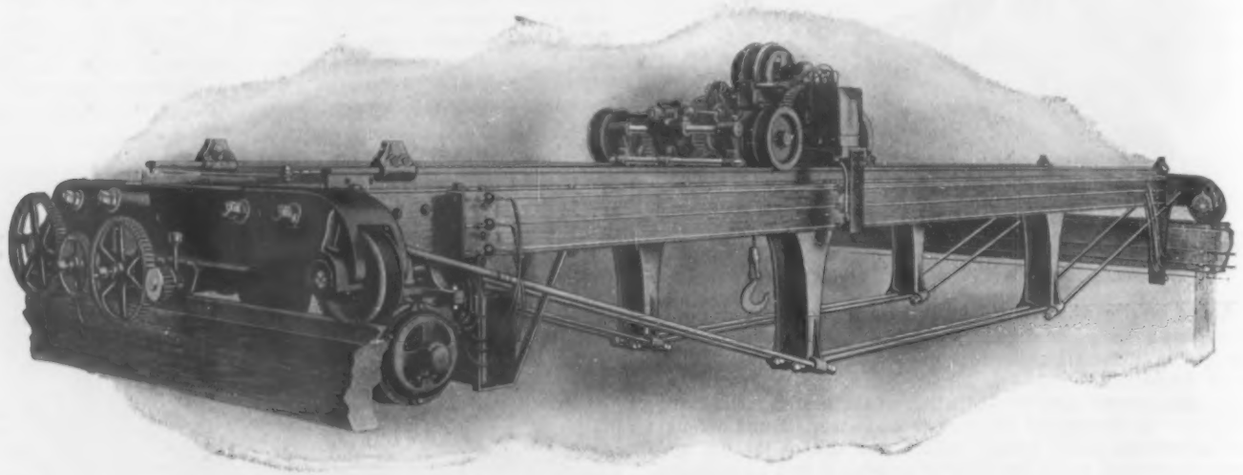
Tubes of cast Nichrome are used in many processes, as in the manufacture of hydrogen and rare gases from the atmosphere, or the treatment of wire in the manufacture of lamps, and also in the ball bearing industry.

A "NEW" CRANE (40 YEARS OLD) ENTERS THE FIELD

The Lane Mfg. Co., Montpelier, Vt., established for 70 years, built their first rope driven overhead traveling crane about 40 years ago. Many of these cranes installed in the early 80's are still rendering full service.

Until this year, all efforts of the Lane Mfg. Co. have been confined princinpally to the stone working field. About 1898, with the increased development of electric power, the Lane crane was adapted to electric drive, and during the past twenty years a large number of these electrically driven cranes have been installed largely in their original field—the stone-working field—throughout the country. Although most of the installations have been in the New England States, Lane cranes are now in service in many States from the Atlantic to the Pacific.

Hence, although so long established, it is easy to understand why the Lane Crane has not been better known in fields outside of the stone working trade. They have now appointed as their sole crane agents, N. B. Payne & Co., 25 Church street, New York, who will make it their business to give the Lane crane a broad distribution throughout the United States—wherever cranes are needed. Herewith are a few of the arguments worthy of consideration that are being presented by N. B. Payne & Co.



A "CLOSE-UP" VIEW OF THE CRANE

TWO MOTORS GIVE THREE MOVEMENTS

A notable characteristic of the Lane electric crane is the employment of two motors for the three movements. Both motors are the constant speed, non-reversing type, which eliminates the use of controllers and complex wiring. Control of all movements, including that of direction by means of a series of friction cones is mechanical.

This design effects a saving in electric power which is ordinarily lost in frequent and quick stops and reversals, and speeding up or slowing down of variable speed reversing motors.

Originally Lane cranes were furnished with timber bridge girders, stayed with steel truss rods fastened to cast iron bridge trucks and having a safety factor of about 7. This construction has the advantage of being exceptionally light for a given capacity. Where desired, timber bridge girders, as shown in Fig. 1, are still furnished. In fact, bridges are now supplied in three styles:

No. 1.—For short spans; rolled steel I-beams, reinforced with inverted channels riveted to the top flanges when necessary.

No. 2.—Steel girders of the lattice box section type for long spans, Fig. 2.

No. 3.—Heavy timbers of long leaf yellow pine reinforced by large steel truss rods as shown by Fig. 1.

In all cases, these bridges are designed with a large factor of safety—at least 5, and with ample strength to sustain the load without undue deflection, horizontally or vertically.

The bridge girders of this crane are supported by cast iron end trucks, provided with cast iron double flange chilled wheels, which have steel axles running in renewable bearings. The trolley is made of cast iron, is designed for rigidity, compactness, accessibility of all parts, and is suitably reinforced with steel tension rods. The sides are joined together by several large steel shafts. Power for hoist and trolley movements is transmitted by friction cones through steel worms, engaging bronze gears running in oil. These friction cones are plainly visible in Fig. 3.

The worm-gear drive is a simple and effective load brake, being controlled by a convenient hand wheel. Two speeds of the hook are furnished with one part of rope. A luff block is provided with a hook and hinged housed sheave, so that by running the line through this sheave and attaching the single rope hook to a girt on the underside of the trolley a two-part reaving of the rope is effected, thereby dividing the first two speeds by two and doubling the power, supplying four hoist speeds.

MOVING BARS AND SHEETS IN A STOREHOUSE

For example—the following are approximately the speeds for a 10-ton standard crane:

No load—40 feet per minute with one part of rope.
2½ tons—20 feet per minute wtih one part of rope.
5 tons—10 feet per minute with two parts of rope.
10 tons—5 feet per minute with two parts of rope.

The hoist motor, through the same power cones, operates the trolley motion on the bridge at approximately 100 feet

per minute. The reverse is obtained in the same manner as with the hoist movement. All movements are controlled by hand wheels. There is no complicated wiring, there are no large controllers and there are no hot resistances, hence, no ability to handle delicate electrical equipment is required of the operator.

The bridge motor drives a friction disc by transmission through a pair of opposed cones, alternately contacting therewith. Control of the bridge travel movement in either direction is effected by shifting the cones by means of a lever connected to a rod running the full length of the bridge convenient to the operator's left hand.

A distinctive feature, inherent in this crane is the control of all movements by the operator while seated on the trolley. There he always has a clear view over the hook as well as of all other points below the crane.

In practice, expert crane users have found that the operator is able to place the load quickly and with accuracy, also effecting a saving of considerable time in placing the hook for attachment to the load. The comfort of the operator in sitting at his work is a feature worthy of consideration.

testimonial letters on Lane cranes in the possession of N. B. testimonial eltters on Lane cranes in the possession of N. B. Payne & Co., which is available to anyone interested. In response to a request for the opinion of users, 96 per cent. of them answered favorably, commending the crane as thoroughly satisfactory and a profitable investment.

In summing up it is claimed by the manufacturers that this crane has five special points of superior merit, as follows:

1st: Maximum longevity of service—a record of 30 years;
2nd: Minimum power and repair cost;
3rd: Great overload capacity;
4th: High return value on capital investment; and
5th: The crane can be operated by inexperienced labor.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

TORRINGTON, CONN.

A big addition to the new plant of the Fitzgerald Manufacturing Company has just been completed. The addition is two stories high, 150 x 50 feet, of brick construction. The Fitzgerald company is also planning to build a three-story addition to its Winsted plant in order to take care of one of the biggest contracts for automobile horns ever awarded to a Connecticut firm. The contract is to fill the entire requirements of General Motors for the coming year and calls for about half a million horns.

The government has asked the co-operation of Torrington shippers in an effort to stop the practice of stealing goods in transit. A recent example is that of the capture of freight thieves in Illinois. Several Torrington vacuum cleaners were among the loot of the Illinois thieves. A member of the sweeper organization, George L. Ross, was called as a witness in the case.

George B. Goodwin, representing the American Brass Company, has purchased from the town of Torrington the standing pine trees on the town farm property.

The directors of the Torrington Company of Maine, holding corporation of the Torrington Company of Connecticut, held their annual meeting in New York September 11 and elected the following officers: President, John F. Alvord; secretary and treasurer, Clive B. Vincent; clerk, W. B. Drummond of Portland, Me.; assistant treasurer, Robert C. Swayze. The usual three per cent. quarterly dividend and one per cent. extra were declared, payable October 1 on common stock of record at close of business at noon September 20. The annual meeting of the stockholders of the Maine corporation was held September 9 and the following directors re-elected: John F. Alvord, George B. Alvord, E. A. Carter, W. E. Gilbert, C. B. Vincent, Joseph Remick and Robert C. Swayze. The president of the Connecticut corporation is F. P. Weston.

Corporal Howard D. Farrant of the Coe Brass office force, who served overseas with Battery D, 16th Field Artillery, was cited for bravery in action, but when he returned he kept the fact a secret and it did not become known until one of his fellow-workers happened to secure a copy of the general order which was issued from the headquarters of the 4th division and dated July 30. The order states that "at Chery-Chartreuve, France, August 8-16, 1918, Corporal Farant was acting as a lineman and that he worked incessantly under severe artillery fire, maintaining unusually long and exposed telephone lines which were very frequently cut. In so doing he often exposed himself bravely to great danger."

The accounting departments of the Standard and Progressive plants have been moved to the office of the Excelsior Needle plant of the Torrington Company.

The two-story addition to the Standard plant has been completed.

C. G. Hoerle and Harry F. Burgess have been on an extended trip to Europe for the Union Hardware Company.

Joseph B. Reid, for nearly quarter of a century employed by the American Brass Company, was married September 6 at Buffalo, N. Y., to Mrs. Mae Wagonbach of that city. The ceremony was performed at the bride's home by the pastor of one of the Methodist churches in Buffalo. Mr. Reid was for 20 years employed at the Coe Brass Branch of the American Brass Company and was foreman of the inspecting and shipping departments. He moved to Buffalo over a year ago to assume charge of one of the departments at the Buffalo Branch. During the period of his residence in Torrington he was prominently identified with the Methodist Church and was active in temperance work, being at one time candidate for Congressman from this district on the prohibition ticket. Mr. Reid's first wife died about four years ago. He has three sons and a daughter, all of whom are grown up. His bride is the mother of three sons and daughters.

Lieutenant L. Cleveland Fuessenich, son of ex-Senator Frederick F. Fuessenich, former president of the Hendey Machine Company, has returned home after two years' service overseas. He went to France with the 26th division and when that division was sent home Lieutenant Fuessenich secured a transfer to the military police.

Lieutenant Paige A. Seaton of the office force of the Coe Brass Branch, American Brass Company, was married September 16 in Winchester to Miss Emily Bronson. Lieutenant Seaton recently returned from overseas, where he served in the aviation corps.

J. H. T.

NEW BRITAIN, CONNECTICUT

SEPTEMBER 25, 1919.—This city, as much as any other manufacturing place in the country, will be seriously affected should the nation-wide steel strike now in progress continue for any great length of time. New Britain, being a hardware center, uses a vast amount of steel yearly, but with their accustomed foresight the manufacturers had previously purchased large quantities of steel in anticipation of some such emergency arising. The stock on hand will be sufficient for quite some period, but a prolonged strike would make itself felt sooner of later. Present indications are that a two month shutdown of the steel mills would cause no industrial embarrassment here. The Stanley Works would probably be the one to feel the effect first, as its cold rolled steel mills, both here and in Bridgewater, Mass., use large quantities. Last year the Stanley Works produced 30,000 tons of steel for the government. Landers, Frary & Clark is another local concern using quantities of steel, chiefly in its cutlery department, and the American Hardware Corporation, the New Britain Machine Company, and other factories also use much steel. While the leaders of the factories here are not at all worried as yet, should there be an emergency fully 10,000 workmen here would feel the effect.

Directors of the New Britain Machine Company, at a meeting on October 25, voted to recommend to its stockholders that the

capitalization of the company be increased from $500,000 to $2,000,000. The new issue will be made to stockholders of record on October 1. With the proceeds of the new stock issue the concern will proceed at once in the development of the tractor business on a large scale. This company has been experimenting with a farm tractor for more than a year, and it has been so perfected as to now be available in the market. Demonstrations made show that it is a success. There are two models offered, one for $400 and another for $450.

The directors of the North & Judd Manufacturing Company have also voted to recommend increasing their capital stock from $1,500,000 to $2,000,000, and favorable action is expected on October 7. This increase is made advisable on the recent purchase of the Fitch plant in New Haven, giving the local company a chance to not only increase its output, but also to have tidewater facilities available; also, to care for that pair of its foreign trade, the company has already established a foreign office in Australia.

In all of the local concerns business seems to be good. Labor troubles are conspicuous by their absence, and there is no known attempt being made her at organizing labor unions and switching New Britain from an "open shop" city to a "closed shop" place.

HARTFORD, CONN.

Oct. 6.—In order that certain restrictions concerning building operations might be lifted, the common council of this city has passed an ordinance amending the building code, which went into effect last year, and which, according to some of the manufacturers, is retarding factory building to a great extent. The manufacturers assert that the code, as it was before the amendments were made during the last few weeks, was so stringent that it was likely to result in the loss to Hartford of some interests which were considering locating in this city. The further claim was advanced that the factories now in the city were hampered in expansion because of the limitations imposed on them by the building code, and that as a result it was impossible to make any plans for any big extension.

It is known that some of the factories plan to make additions to their structures, but under the code before it was amended the extensions contemplated could never be carried into effect. With the changes ordered by the governing body of the municipality, however, the indications are that factory building will not be held down, as in the past.

Based on the reports which preceded the passage of the amendments, the common council has approved a resolution providing for the appointment of a special committee, to consist of aldermen, architects, builders and others to go over the code, and suggest changes which might prove beneficial, not only to the manufacturers, but also to the general public. Plans are now being made for this revision of the code.

The Underwood strike, after being in force nine weeks, has been settled, and the workmen have returned to their duties. The employees of some departments of the Underwood Typewriter Company struck for higher pay and for a change in working hours. After a number of departments had joined in the movement, it was decided to close the entire factory. This course was pursued, and conferences finally resulted in the resumption of activities, after more than two months. The strikers realized a neat sum from the proceeds of a tag day.

Stockholders of the Bristol Brass Corporation have received notice that a meeting will be held October 1, "to consider the matter of the increase of the capital stock by the issuance of preferred or common stock." It is reported that the directors will submit a proposition to issue $500,000 preferred stock, bearing 7 per cent. interest.—W. A. L.

WORCESTER, MASS.

Oct. 6.—There has been a considerable brightening in the labor situation here within the past few days, this being especially true regarding the metal industry. When the big steel strike took place, none of the employes of the Worcester division of the American Steel & Wire Company, the city's largest industry, went out. Also strikers in some of the foundries in the city who have been out for about five months have started to return to work.

The molders at the Pond Foundry, the Worcester Tech Foundry and the Star and Standard Foundry companies have returned to their jobs, thus leaving about 100 molders only on strike. A great number of men formerly employed as molders in Worcester have left the city. The molders went on strike May 9. At that time they were getting $5.25 for nine hours. They wanted to enforce the award of the War Labor Board of $5.80 for eight hours work. Details of the settlement which have been reached in the cases of the foundries where the men have gone back have not been announced.

The Clinton-Wright Wire Company of Worcester, which has plants in Clinton, Palmer and Worcester, expanded still further this month when acquisition of the plant of the Spencer Wire Company was effected. This makes the industry one of the greatest wire industries in the world. The Spencer Wire Company, before the merger, was one of the best known in the country, and its plants in Worcester and at Spencer, six miles out from Worcester, have seldom, if ever, felt any lull in business great enough to mean the non-occupancy of their help.

A syndicate headed by E. H. Rollins & Sons and Spencer Trask & Company, has bought and will shortly make public announcement of an issue of $3,500,000 Clinton-Wright Wire Company 8 per cent convertible preferred stock. The outstanding capitalization will then be $3,500,000 first preferred stock, $5,000,000 8 per cent convertible stock and $7,500,000 common stock.

It is understood that the Clinton-Wright Wire Company has entered into a contract with the Spencer Wire Company, by virtue of which it immediately acquires the current assets of that company and its Spencer plant, and leases the Worcester plant on a basis which in twelve years will give it title, free of all encumbrances. The net assets will aggregate over $15,000,000 and the combined plants will have an aggregate floor space of 48 acres and employ 3,500 workers. Gross sales are about $18,000,000 and the average net profits after taxes about $1,875,000.

A number of Worcester men prominent in the metal industry are to attend the International Trade Conference at Atlantic City. Delegates from Europe will be conferred with. John H. Fahey, publisher of the Worcester *Evening Post*, is chairman of the committee of arrangements for the conference. There will be from five to seven delegates each from England, France, Italy and Belgium and in addition a force of secretaries, making a party of about 50. It is expected that about 3,000 American business men will confer with the delegates.—W. J. B.

ROME, N. Y.

Oct. 6.—The brass and copper mills of this city are running at a good rate since the readjustment of hours and wages took effect last month, and some of the plants are even operating night shifts. Labor seems satisfied with the new order of things, and production is reported to be up to a high standard, reflecting top notch efficiency on the part of both workmen and factory management in the various shops throughout the metal industry district.

The busy activities in the mill section of the city impress the observer with the idea that haste is being made, not only to catch up with orders that were delayed through the protracted strike, but to keep pace with a constant flow of new business.

The long-established reputation of the Rome mills of manufacturing one-tenth of the copper of the United States will without doubt be maintained and perhaps exceeded, if one may judge from the present display of industrial life now in evidence about the brass and copper plants of this city.

Other than the forecast of a busy future for the Home Industries engaged in the manufacture of brass and copper articles, running all the way from brass tacks to heavy gauge sheet copper, there is nothing else of interest to the trade that could be learned at this writing.—M. J. D.

PITTSBURGH, PA.

Oct. 6.—The eyes of the entire business world in the Pittsburgh district are centered on the strike situation with the steel industries and a slackening up in all lines is in evidence pending the outcome. The majority of the mills here are operating at almost full capacity and very little rioting has occurred.

The metal industries here continue to experience a brisk demand, however, and labor conditions are good. The raw ma-

terial supply is showing improvement, with shipping conditions on the ascendancy. With the railroad shopmen's trouble settled, carriers are expected to be more plentiful right along, as some headway is now being made toward getting crippled cars in good running condition.

The METAL INDUSTRY representative talked with Cassius M. Miller, general manager of the Basic Mineral Company, a few days ago, and found him well pleased with business in general. They are more than rushed with orders for the flaxes put out by them and which are used in the melting of various metals. Their aluminum flux is experiencing an extra heavy demand. The repairs and additions to the building at 834 Columbus avenue are about complete and the finished structure is going to add much to the appearance of properties in this vicinity. Mr. Miller reports conditions good at their mines.

The Lara Crucible Company are in their new location at 1603 First National Bank Building. With recent additions to their kiln capacity, now complete, they are turning out crucibles in larger quantities.

With the Hanlon-Gregory Company, galvanizers, business is about the same as during the past month or so, but expectations are that the coming fall will find a brisker market.

The Damascus Bronze Company ball team holds the pennant in the Manchester league for the 1910 season. Bowling teams and a basketball team are now in the course of organizing and a big winter of indoor sports will keep things moving nicely. Mr. Frank, of this concern, reports business just as good as ever. The steel mill trouble is in no way affecting demand for their product. His men are staying right on the job and no indication is at hand for labor trouble.—J. A. C.

CINCINNATI, OHIO

Business has been rather slow in all lines of metals in Cincinnati and the surrounding territory during the most part of September. Prices that were always on the upward trend have begun to recede in sympathy with the steel strike workers, but with that trouble out of the way, it is believed that the prices of all metals will go right back to the high level attained in the past several months.

Local members of the trade report inquiries light at present, but they are most optimistic over the outcome of the future. Labor conditions in the trade in this section of the country are better than they have been in the past few months and little trouble of any kind is feared by the employers from this source.

Several of the plants have been affected during part of the time this past summer, but they are again operating on a full-time basis. The fall and winter is expected to bring to the trade business in such volumes that will more than make up for whatever setbacks the trade has had during the hot weather. With production in all lines of industry away below normal and an expected boom in all kinds of business for the coming months it is natural to expect that the metal trades will receive their share of this prosperity. At least, that is what all the members are hoping for, and they will be a disappointed lot if the same does not come true.

Building operations in this part of the country are expected to increase in leaps and bounds, there being a gradual increase week after week, although the jobs are comparatively small, but most of them require considerable metal products, most of the hardware going into the jobs being of the finest. All metal products men report their business in fine shape and the volume increasing with nice prospects in sight, so that there does not appear any cause for worry at this time over the future of the business.

The annual conventions of the International Metal Polishers' Union will be held each year in Cincinnati, it was decided at the convention held here recently. The conventions will be held here every year in September. As a result of the meeting here a general convention of all metal trades will be held in the near future. Among the organizations expected to send delegates to this convention, which has nothing to do with "the big union idea," but has to do with closer affiliation, are iron molders, sheet metal workers, pattern makers, boiler makers, blacksmiths, electrical workers and metal polishers. H. C. L.

Owing to the printer's strike our correspondence pages are incomplete. We will make up the deficiency in our subsequent issues.

CLEVELAND, OHIO

OCT. 6.—National strike among the steel workers of the country, and which walkout seems to have affected Cleveland district plants more seriously than those in any other center of the country, is the big factor that confronts members of the metal industry in this section as the first week of the battle between the biggest labor and the biggest capital factions of the country's industry closes. So far none of the far-reaching effects anticipated when a strike order began to take form have come to light. Practically all plants allied with the metal industry are continuing to operate at capacity production and consuming interests have not been retarded in their output, whether it be automobiles or household utensils. But it is frankly admitted that the next three weeks, or November 1, the latest, should the strike continue that long will see the brakes being applied as the supply of raw materials begins to slacken. Before the strike actually became effective large steel producing plants here refused to accept any new business, specifying six weeks the earliest time in which they would consider new business. This will mean that while many industries in the metal working crafts do not need steel, there are parts, machinery, equipment and countless other angles that will feel a shortage of supply, and which cannot continue to operate.

Meanwhile plans for continuing production in all lines allied to the industry continue, while new projects, some of which are the biggest of their kind for Cleveland territory, are being pushed into being. Foremost among these may be considered a giant automobile body plant, backed by a $12,000,000 corporation now forming. This will be an entirely new project for this district. The extent of its operations may be estimated by the fact that it proposes to turn out 500 bodies a day when in full operation at the start. It is figured that practically the entire early output will be taken by Cleveland automobile interests, which include approximately ten big firms.

Another development in this particular angle of the industry is the plan for expansion by the Brown Auto Carriage Company, which has been reorganized into the Brown Body Corporation, with $1,000,000 capitalization. This firm has acquired three and one-half acres in the eastern factory district, where it proposed to erect a $500,000 plant. P. J. Brown is president and Carl Halle treasurer of the company. The company's present Superior avenue plant will be retained as a service station. Merger of several large body plans also is hinted at during the last few days, for which Harry Shepler, formerly vice-president of the Willys-Overland, Inc., Toledo, is said to be slated for manager. No confirmation of such an amalgamation has been made as yet by present body companies, however.

Big outlet for metal products in connection with moderate priced automobiles, in which Cleveland interests are expected to share largely, also is seen in the report that the Overland interests propose to establish a plant at Elyrie, Ohio, about fifteen miles west of Cleveland, believed to be inspired by the labor troubles of Toledo some months back. Progress of this development, however, will depend upon the labor situation in the Cleveland district.

The General Bronze & Foundry Company is among the first firms in this industry to acquire land in a new sixty-one acre tract with railroad and switching facilities being opened up by financial and real estate interests in the southern section of the city.

Still another outlet for more business is seen in the preliminary plans of Detroit interests toward organizing a new automobile company here to make a car of the $3,000 or $4,000 class. These interests already are inquiring for land, materials and equipment. The project is believed to be backed by the Leland interests of the Lincoln Motors Corporation. Inquiries for land are for 50 or 60 acres, which will give an idea of the size of this particular project. Inquiry for materials, and machinery, bear the statement that quick delivery is essential.

Metal parts plant for its own use has been taken over by the Jordan Motor Car Company in the purchase of the property of the Metal Parts Manufacturing Company, which adjoins the eastern Cleveland plant of the Jordan interests.

Extension of its operations are planned by the Cleveland Tractor Company through the construction of two additional buildings to cost approximately $400,000. The completed units will give this firm one of the largest manufacturing establish-

ments under one roof in Cleveland manufacturing circles, the total space being 310,000 square feet.

Factory for the Vita Manufacturing Company on the west edge of the city will be built this year. The company manufactures the Rogers magneto, designed by George D. Rogers, president of the company.

COLUMBUS, OHIO

Oct. 6.—Fall activity in various branches of the metal market in Columbus territory is now under way. A large majority of metal using concerns have a good run of orders and are buying metals to keep their plants going. Some strikes have affected metal manufacturing to a certain extent, but as yet the situation in that direction is not serious. Users generally are placing small orders only, being content to work from hand to mouth, as it were, without accumulating any surplus of consequence.

One of the features of the Columbus trade is the demand for babbitt and type metals which is holding up remarkably well. In fact, there has been a marked increase in this demand during the past month. Copper is also in fair demand, with prices ranging between 22½ and 23 cents. Brass stocks are moving fairly well around 21 cents. Tin is fairly good and the same is true of zinc. Aluminum is probably the weakest point in the market at this time, although there is a fair volume of business reported. The general trend of the market is steady, with prices well maintained at former levels.

There is not as marked a shortage of labor in Columbus metal using plants as formerly. Some of the concerns are still short of skilled workmen, however, and frequent advertising in newspapers is resorted to.

The capacity of the plant of the Regent Brass Company, of Marysville, Ohio, is being doubled by the erection of a large addition. More equipment will be installed soon.

The authorized capital of the Atlas Brass Company, of Columbus, has been increased from $65,000 to $155,000.

Preliminary arrangements have been completed for the erection of a $125,000 factory building at Wooster, Ohio, to house the Buckeye Aluminum Company.

The capital of the Dayton Metal Products Company, of Dayton, Ohio, has been increased from $200,000 to $6,000,000. The increase is for the purpose of enlarging the plant.

The Metals Welding Company, of Cleveland, has been chartered with a capital of $200,000 by John Rice, H. E. Edwards, H. H. Snyder, E. C. Reader and H. H. Hatch.

The Columbus Metal Products Company, of Columbus, Ohio, has been chartered with a capital of $10,000 by E. C. Lloyd, DeWitt H. Wyatt, Bert Wolman, L. Russell Molycross and Edward C. Oswald.—J. W. L.

DETROIT, MICH.

Oct. 6.—General unsettled conditions are causing some anxiety among the brass, copper and aluminum industries of the city and surrounding country, but otherwise there is nothing of consequence to disturb general labor here.

If the steel strike should really succeed in tying up that industry it certainly would react on the automobile industry and cause practically every plant either to curtail output, or else discontinue altogether. If such a thing should occur the brass, copper and aluminum industry would be seriously effected, because these two trades are very closely allied. Neither is independent of the other in any stage of production.

Few manufacturers, however, believe that the steel strike will reach such proportions as seriously to cripple the Detroit and Michigan automobile plants, although the amount of steel on hand is limited. Just at present, however, all brass, copper and aluminum industries here are doing a great business. Bolstered by the great automobile plants, there is every indication that their prosperity will continue at high tide for a long time to come.

The plant of the Slaymaker Electric Welding Company, which was destroyed by fire August 22, has been repaired and new equipment installed. Among the improvements is an elaborate system of ventilation, besides traveling hoists and other modern equipment which, it is said, places this plant among the foremost of the kind in the country. The oxy-acetylene welding department now occupies half of the floor space.

It is expected that the Holmes Foundry Company, which lost its plant by fire about six months ago, will be ready to begin operations again about October 1. The new plant is practically fireproof.—F. J. H.

CHICAGO

Oct. 6.—Members of the various branches of the metal trades in this section have little to complain of, either in the matter of business on hand or of business for the future. As indicated by the reports given by manufacturers who were represented at the recent national meeting, orders on hand run four or five months ahead of the ability of the trade to meet them, although maximum operations are now the rule, although new business coming in is continually in excess of the current capacity of the manufacturers to handle it, aside from the back orders referred to. All branches of business seem to be contributing their share to this gratifying flood of orders, and the net result is as shown, making it certain that the trade will have plenty to do for some time to come.

The most obvious explanation of this remarkable activity is that which is given for many other similar manifestations in the business world. That is, the war claimed virtually the entire capacity of the trade and its plants while hostilities were going on, which meant that the ordinary run of business had to be thrust aside entirely, to make room for the more pressing demands of the Government. Since a peace status has been resumed, the business postponed by the war has simply poured in upon the trade, after being dammed up for a period of about two years. Taking this with the undoubtedly strong demand resulting from a general stimulus to all sorts of business, it is easy to see why there is a plethora of orders.

The end of the long lockout and strike in the building trades has formed another factor of a very favorable sort for the metal industries, inasmuch as concerns specializing in building hardware, as well as those making metal goods for plumbing equipmnt, were obviously, if indirectly, affected. The carpenters' demarl for a dollar an hour was finally met, but not until after the best part of the summer's building season had passed. Building work has now been resumed, and will continue under pressure, in an effort to regain some of the lost time, as long as the weather will permit. The inadequacy of housing in the city to the needs of the population is such that it is certain, barring more labor trouble, that next spring will see the most extensive building activity ever seen in Chicago.

A leading concern in the metal industry, the Crane Company, of Chicago, has been suffering from one of the most astonishing of the numerous remarkable and inexcusable strikes called in various parts of the country. This company, which operates a model plant, embodying the various processes called for in the production of its big line of valves as well as of its well-known plumbing goods, has always been considered as an ideal employer, and its employes exceptionally fortunate to be with such a concern. The strike called came as a bolt from the blue, immediately after a week's holiday given during the Fourth of July week, following work by agitators for objects which still remain mysterious, as the employes have no demands and no complaints.

Fortunately, however, the metal trades as a whole are at present free from labor troubles, and should they continue so, will undoubtedly experience a period of great activity and prosperity. —K. C. C.

PHILADELPHIA, PA.

Metal industries of Philadelphia generally are plugging along in the same old way; no unusual boom in business is being felt, neither is there any indication of serious trouble in the labor situation. Comparative serenity prevails in sharp contrast to the wild frenzy apparent in the ranks of labor in many other leading centers of industry. Aside from a few scattered instances of slight shop troubles, which have been quietly settled without publicity, no upheavals have taken place in metal working plants. In the general business life of the city there have been a few troubles, such as strikes by bricklayers, barbers, and some readjustments in the textile trades.

Wages have had no recession since the armistice was signed, and slight increases have been granted in some lines of metal work. There is no particular shortage of help here, with the exception of skilled women workers. The general experience has been that women who took up mechanical work as a matter

of patriotism during the war have dropped it, and shops which found it advantageous to employ female labor in many operations now find difficulty in inducing them to work, in spite of higher wages offered.

None of the steel mills in the Philadelphia district reported any trouble during the first week of the national steel strike. The common feeling among industrial plant managers has been that the steel strike would bring the labor issue to a head and tend to give a permanent settlement to the problems that have been the chief source of uncertainty in business for the last six months.

Although the non-ferrous foundries and shops have not been over-rushed with orders, many new inquiries have been received recently, giving indications of heavier business during the fall and winter months. The larger machine shops and heavy machine tool builders have considerably better prospects than during the spring and summer, with many new orders for railway and construction equipment. Plants engaged in manufacture of small specialties and automobile parts and accessories are very busy.

The Haverford Motorcycle Company has taken over the Philadelphia plant of the Savage Arms Company at Erie avenue and Sepviva street, which was organized for war work. New equipment is being installed and old equipment being rearranged so that the plant will soon be in shape for production by the Haverford company.

The Wright Roller Bearing Company, Twentieth street and Indiana avenue, has increased its capital stock from $1,000,000 to $2,000,000.

Thousands of attendants at recent business conventions in Philadelphia have visited various plants of the city, forming new personal acquaintanceships which undoubtedly will prove of value to local manufacturers in the future in the way of new business. During the Foundrymen's convention special efforts were made for the accommodation of visitors who desired to visit metal plants in all parts of the city. One week before the foundrymen were in the city, more than 1,000 members of the National Association of Purchasing Agents held their convention here and many visits were made to industrial plants. Among the metal shops and foundries visited were the Ajax Metal Company, American Bronze Corporation, American Pulley Company, Atwater Kent Manufacturing Company, William Cramp & Sons' Ship & Engine Building Company, Electric Storage Battery Company, Girard Iron & Metal Company, Hess-Bright Manufacturing Company, U. T. Hungerford Brass & Copper Company, J. W. Paxson Company, George F. Pettinos, Philadelphia Roll & Machine Company, Trumbour-Whitehead Brass and Copper Company, United Lead Company of Pennsylvania, Welsbach Company, White & Brother, and many others in allied lines of manufacture.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

Bridgeport Rolling Mills Company, Inc., Stratford, Conn., has increased its capital from $150,000 to $300,000.

The Toledo Metal Producing Company, Spitzer building, Toledo, O., expect to start the construction of a factory about January 1, 1920.

Hammacher, Schlemmer & Company, 133 Fourth avenue, New York, have recapitalized for $1,800,000. They manufacture tools, machinery, cutlery and other metal products.

The Stanley Rule and Level Company, 111 Elm street, New Britain, Conn., has awarded the contract for a two and six-story 30 x 36 and 40 x 60-foot factories. Estimated cost $38,000.

The Galt Brass Company, Ltd., Galt, Ontario, have increased their capital to $500,000. They operate the following departments: Brass foundry, brass machinery shop, tool room, plating and polishing.

Smith Metal Arts Company, 887 Niagara street, Buffalo, N. Y., incorporated with $100,000, by F. C. Smith, C. F. Damm, and A. H. Jamieson. They have spinning, plating, stamping, soldering and polishing departments.

The Bridgeport Crucible Company, Bridgeport, Conn., which was formerly owned by the Buffalo Brass Company, has discontinued business since the amalgamation of the latter company with the American Brass Company.

William Allen Ragan, for years connected with the aluminum and white metal alloys business of Indiana, Ohio, and Michigan, has started the Ragan Sales Company with offices in Indianapolis, selling all metals excepting pig iron and steel.

The General Metal Crafts Co., New York, has been incorporated with a capital stock of $100,000 by J. Agazim, G. G. Greenburg and G. T. Cullen, 1457 Broadway. They will operate plating, stamping, soldering, polishing, and lacquering departments.

The Hart and Cooley Company, Inc., New Britain, Conn., manufacturer of heating registers and other iron and metal products, has increased its capital by $50,000, making a total outstanding stock of $550,000. They operate a tool room, plating, japanning, polishing and lacquering shops.

The Coppus Engineering & Equipment Company, Park avenue, Worcester Mass., manufacturer of pumps, turbine blowers and kindred products, is planning for the erection of a one-story addition to be used as a foundry. With equipment it is estimated to cost about $75,000. They operate brass, bronze and aluminum foundries.

After an extensive investigation of the various types of electric furnaces and a visit to the U. S. Navy Yard at Puget Sound where a 6-ton "Greaves-Etchells" furnace is in operation, the Vancouver Engineering Works, Ltd., Vancouver, B. C., has given an order to the Electric Furnace Construction Company for a "Greaves-Etchells" furnace.

The St. Paul Welding Company, 173 West Third street, St. Paul, Minn., is having plans prepared by M. A. Wright, Architect, Pittsburgh building, for the erection of a two story, 36 x 75-foot welding shop. Estimated cost, $20,000. They do job welding and manufacture oxy-acetylene equipment. They operate a brass machine shop and brazing shop.

Hoef & Company, 400 North Ashland avenue, Chicago, Ill., manufacturers of die and metal specialties, have awarded the contract for a one and two-story 120 x 120 factory to be erected on Kinzie avenue near Paulina street. Eseimated cost, $35,000 to $50,000. The plant will include a tool room, cutting up shop, galvanizing, stamping and tining plant.

The Metlyat Company, Worcester, Mass., has opened offices in the Park building, and is seeking factory space in which it will manufacture model yachts, using galvanized steel as the material. The intention is to build scientifically correct models, instead of the usual toys. The officers are: President, F. S. Dart; vice-president and production manager, C. A. Hales; treasurer, A. W. Pratt; secretary, R. W. Rambo. They operate a brass machine shop, casting shop, plating, japanning, stamping, soldering and lacquering departments.

Messrs. Dantzig, Pfeiffer & Ritt, have opened offices at 500 West One Hundred and Sixteenth street, New York City., as consulting mathematicians. They will carry on work along the line of mathematical formulation for patent claims of principles underlying inventions; mathematical treatment of problems in mechanism; problems in statistics and probability; design of measuring and computing apparatus; design of optical instruments; graphs, diagrams and charts; scientific development of inventions; expert testimony in litigation; problems in aeronautics; other mathematical investigations.

The Sheldon Company, New York City, have moved their office to 41 Park Row. They have taken over the Yoder Company's account for this territory and are handling for them their sheet metal working machinery, which not only covers the ordinary sheet metal working trades, but particularly automobile sheet metal work. They have also taken over the account of the Pipe and Tube Bending Corporation of America for this territory and have exclusive sale for their Bent Pipe and Tube in Massachusetts, Rhode Island and Connecti-

THE METAL INDUSTRY

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PRINTED MATTER RECEIVED

A folder on the **Barrett Portable Adding Machine.**

Graylite, by the Joseph Dixon Crucible Company, with items of general interest.

Dochler Topics.—A factory monthly, brisk, snappy, alive and interesting to its readers.

The Punch Press.—A monthly booklet with a "punch," issued by the Globe Machine & Stamping Company, Cleveland, O.

A. P. Manning & Company.—Bulletin 1,000 on buffing and polishing compositions; featuring Zucker's Acme Brands. The object of this bulletin is to place before the user of buffing compositions, facts which have hitherto been either unknown or improperly explained.

The Valve World from Crane Company.—It invites authoritative experts in modern heating and sanitation to write, exclusively for it, concise, practical, informative articles on heating, plumbling, ventilation, and kindred topics affecting the modern building—home, apartment, hotel, office building, store, factory, warehouse, theater, public building, hospital, etc. Also articles on public sanitation, comfort stations, swimming pools, etc.

At the request of the Federal authorities, **The Merchants' Association** has compiled a summary of its war activities, which it has printed in pamphlet form for distribution among its members. It shows an astonishing amount of patriotic activity before, during and since the war. It is estimated that three-quarters of the work done by The Association was applied to aspects of the world conflict between April, 1917, and November, 1918.

The National Safety Council announces an affiliation with the University of Cincinnati for the purpose of carrying out a program that is unique—almost radical—both to the fields of education and accident prevention and that opens a new and promising avenue for the service of the council.

Briefly, this program includes the establishment of an industrial medicine division at the University of Cincinnati where medical students and graduate physicians will be given special training not only in industrial medicine, but in industrial relations, including sanitation and all the fundamentals of safety work as well.

New literature exploiting products manufactured by **The New Jersey Zinc Company,** of 160 Front street, New York, has just been issued. Five small booklets entitled respectively, "Chemicals," "Metals," "Rolled Zinc," "Zinc Dust" and "Pigments," comprise that company's latest publicity efforts.

"Chemicals" describes the various grades of Sulphuric Acid produced by the company, as well as Muriatic Acid, Zinc Chloride, both fused and solution, and Salt Cake..

The various brands of Zinc Oxide made under the French and American processes, together with "Green Label" and "Standard" Lithopone and Ochre are featured. A description of Zinc Dust brands fills one of the books bearing that name, while Rolled Zinc, its uses and characteristics feature another.

In "Metals" are to be found descriptions and analyses of the various grades of Slab Zinc, including the famous Horse Head brand; also mention of Spiegeleisen and bullion.

Copies of these booklets may be secured upon request.

Walter C. Gold, of Philadelphia, has recently issued his latest catalogue on Grinding Wheels. This work contains a number of features not incorporated in other wheel catalogues extant. The opening page refers to some valuable suggestions for ordering grinding wheels. This guide will be especially appreciated by those who do not order frequently, as it indicates concisely just what information must be submitted to intelligently fill an order.

Pages 5 and 6 are devoted to an explanation of Carbide of Silicon and Aluminum Oxide used in the manufacture of Keystone Grinding Wheels, and, also, to short descriptions of the vitrified, silicate and elastic processes used in wheel making.

Page 6 refers to Aluminum Oxide and Carbide of Silicon Wheels made by the "rubber" process in which the abrasive is mixed with the finest grade of Pará rubber and vulcanizing agents.

Pages 16 and 17 comprise Mr. Gold's article on "Grinding Wheels" containing some interesting history and information concerning grinding wheels, past and present.

A large portion of the book presents cuts of grinding wheels which fit various standard grinding machinery.

Pages 86 to 96 cover Grinding Wheel Dressers and Cutters. Here is published some original data concerning grinding wheel dressing, the cutting action of grinding wheels, cutter steel and diamonds used for ordinary wheel dressing and the diamond in precision grinding.

The last portion of the catalogue presents grinding wheel machinery.

SUPREME COURT OF JAPAN PROTECTS AMERICAN TRADE MARK

The Supreme Court of Japan, in a suit instituted by a Philadelphia manufacturing company for the protection of its trade-mark rights, has handed down a decision which must rank as epochal in international trade.

The decision, in unqualified terms, upholds every essential of trade-mark rights guaranteed under Japan's treaty agreement with the United States. It safeguards not only American trade-mark owners, but owners also in every other country having similar treaty agreements with Japan. It places the spirit of the law of Japan on a plane equal to that occupied by Western peoples, and it affects, directly and most favorably, manufacturing interests involving annual production amounting to billions of dollars.

The trade-mark concerned in the litigation is that of the **Miller Lock Company,** of Philadelphia. The very existence of this mark is due to the evil practice of piracy of good will, as good will inheres, in a trade name representing the consuming public's sole means of identifying any meritorious article for product.—*Philadelphia Chamber of Commerce News* Bulletin.

VANADIUM COMPANY OF AMERICA

Mr. Replogle and Charles M. Schwab have bought the mines in Peru and the mills in Pittsburgh of the American Vanadium Company. Mr. Replogle is to be president.

He and Mr. Schwab it is said, now directly control about 98 per cent of the vanadium supply in the world.

The company will probably be known as the Vanadium Company of America, and the assets of the old company, controlled by the Flannerys of Pittsburgh, and sold to the new company will probably be liquidated at $800 or $900 a share.